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RESULTS OF WIND TUNNEL TESTS ON A 0.010
SCALE MODEL (72-OTS) ROCKWELL SPACE SHUTTLE
VEHICLE IN THE LARC 8-FOOT TRANSONIC
PRESSURE TUNNEL (LA113)

SPACE SHUTTLE AEROTHERMODYNAMIC DATA REPORT

Data ManAGEMENT SERVICES

HUNTSVILLE ELECTRONICS DIVISION  **CHRYSLER**
CORPORATION

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Prepared under NASA Contract Number NAS9-16283

by

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for

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Johnson Space Center
National Aeronautics and Space Administration
Houston, Texas

WIND TUNNEL SPECIFICS:

Test Number: LaRC 8 Ft. TPT 787
NASA Series Number: LA113
Model Number: 72-OTS
Test Dates: August 5 - 9, 1977
Occupancy Hours: 28

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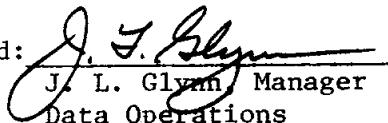
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Chrysler Corporation Space Division assumes no responsibility for the data presented other than display characteristics.

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ABSTRACT

An experimental investigation was conducted in the NASA/LaRC 8-ft. Transonic Pressure Tunnel to verify earlier tests results (IA244) of the 72-OTS model in the same tunnel. Only a limited amount of data (17 runs) were obtained at a single Mach number of 0.9 on model configurations tested previously. These being: 1) integrated vehicle with single sting/balance in orbiter; 2) integrated vehicle with triple sting/single balance in orbiter - no O-T interstage hardware; 3) configuration 2 with interstage hardware attached to orbiter; 4) configuration 2 with interstage hardware attached to tank; 5) orbiter alone.

Other test variables were angle of attack which varied from -8° to 4° at sideslip angles of 0° and $\pm 6^{\circ}$ and Reynolds number which was either 3.36 or 3.98 million per foot. This report presents complete data tabulations and basic vehicle aerodynamic characteristic plots.

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c
 A) C_L , C_D , C_A , C_m , L/D, vs α , C_m vs C_N ,
 C_L (BODY), C_n (BODY), C_Y vs α

NOMENCLATURE
General

<u>SYMBOL</u>	<u>MNEMONIC</u>	<u>DEFINITION</u>
a		speed of sound; m/sec, ft/sec
c_p	CP	pressure coefficient; $(p_1 - p_\infty)/q$
M	MACH	Mach number; V/a
p		pressure; N/m ² , psf
q	Q(NSM) Q(PSF)	dynamic pressure; $1/2\rho V^2$, N/m ² , psf
RN/L	RN/L	unit Reynolds number; per m, per ft
V		velocity; m/sec, ft/sec
α	ALPHA	angle of attack, degrees
β	BETA	angle of sideslip, degrees
ψ	PSI	angle of yaw, degrees
ϕ	PHI	angle of roll, degrees
ρ		mass density; kg/m ³ , slugs/ft ³

Reference & C.G. Definitions

A _b		base area; m ² , ft ²
b	BREF	wing span or reference span; m, ft
c.g.		center of gravity
$\ell_{\bar{c}}^{\text{REF}}$	LREF	reference length or wing mean aerodynamic chord; m, ft
S	SREF	wing area or reference area; m ² , ft ²
	MRP	moment reference point

NOMENCLATURE (Continued)

<u>SYMBOL</u>	<u>MNEMONIC</u>	<u>DEFINITION</u>
	XMRP	moment reference point on X axis
	YMRP	moment reference point on Y axis
	ZMRP	moment reference point on Z axis

SUBSCRIPTS

b	base
l	local
s	static conditions
t	total conditions
∞	free stream

Body-Axis System

C_N	CN	normal-force coefficient; $\frac{\text{normal force}}{qS}$
C_A	CA	axial-force coefficient; $\frac{\text{axial force}}{qS}$
C_Y	CY	side-force coefficient; $\frac{\text{side force}}{qS}$
C_{Ab}	CAB	base-force coefficient; $\frac{\text{base force}}{qS}$ $-Ab(p_b - p_\infty)/qS$
C_{Af}	CAF	forebody axial force coefficient, $C_A - C_{Ab}$
C_m	CLM	pitching-moment coefficient; $\frac{\text{pitching moment}}{qS\ell_{REF}}$
C_n	CYN	yawing-moment coefficient; $\frac{\text{yawing moment}}{qSb}$
C_ℓ	CEL	rolling-moment coefficient; $\frac{\text{rolling moment}}{qSb}$

NOMENCLATURE (Concluded)

Stability-Axis System

<u>SYMBOL</u>	<u>MNEMONIC</u>	<u>DEFINITION</u>
C_L	CL	lift coefficient; $\frac{\text{lift}}{qS}$
C_D	CD	drag coefficient; $\frac{\text{drag}}{qS}$
C_{D_b}	CDB	base-drag coefficient; $\frac{\text{base drag}}{qS}$
C_{D_f}	CDF	forebody drag coefficient; $C_D - C_{D_b}$
C_Y	CY	side-force coefficient; $\frac{\text{side force}}{qS}$
C_m	CLM	pitching-moment coefficient; $\frac{\text{pitching moment}}{qS_l \text{REF}}$
C_n	CLN	yawing-moment coefficient; $\frac{\text{yawing moment}}{qS_b}$
C_ℓ	CSL	rolling-moment coefficient; $\frac{\text{rolling moment}}{qS_b}$
L/D	L/D	lift-to-drag ratio; C_L/C_D
L/D_f	L/DF	lift to forebody drag ratio; C_L/C_{D_f}
δe_I	IB-ELV	inboard elevon deflection angle, degrees
δe_O	OB-ELV	outboard elevon deflection angle, degrees

INTRODUCTION

During post test analysis of Space Shuttle test IA244 (reference 1) several aberrations in the data were observed. It was decided that a second entry into the tunnel under the same test conditions would be desirable and beneficial. Therefore, Langley Research Center was given an action item to conduct a short verification test on Rockwell test IA244. This was accomplished by LaRC as test LA113, being conducted in the LaRC 8 ft. Transonic Pressure Tunnel during early August, 1977. Five configurations were tested in order to determine orbiter-external tank interstage hardware effects on the total vehicle. Six component force and moment data from the single balance in the orbiter were recorded at a single Mach number of 0.90 over an angle of attack range from -8° to 4° at sideslip angles of 0° and $\pm 6^{\circ}$. Additionally, base pressures were measured at locations shown in Figure 2e. Reynolds number was either 3.36 or 3.98 million per foot.

This report details the conditions under which the tests were conducted and presents the results with analyses.

PRESENTATION OF DATA

Figure 4 presents the longitudinal aerodynamic characteristics of the five configurations tested at zero sideslip. A comparison of the lift coefficient, page 1, of the orbiter alone (square symbols) with that of the orbiter in proximity of the tank (diamond symbols) shows that the presence of the tank produced a positive increment in lift at the negative angles of attack which decreased linearly to essentially zero at about 4 degrees positive angle of attack. Adding the interstage hardware to either the orbiter (equilateral triangle symbols) or the tank (right triangles) produced a nearly identical positive increment in lift throughout the angle-of-attack range. This was not unexpected since the influence of the interstage hardware on the pressure field between the vehicles would tend to be much stronger than any actual lift generated on the interstage hardware itself. The small differences shown are probably due to the physical differences between the unattached ends of the interstage hardware (see the photographs in figures 3b and 3c). Larger differences were shown between the same configurations in reference 1, which may be attributed to the differences in the physical clearance gaps and seals during the tests of reference 1. Although considerable care was exercised to maintain the gaps and seals during the tests of reference 1, it is felt that there was more certainty as to the gap and seal configuration for the test reported herein (LA113), since the contrast between the results of reference 1 and other tests in this program was the primary reason for these repeat tests.

PRESENTATION OF DATA (Continued)

A comparison of the axial force coefficients, page 3, shows that the presence of the tank (diamond symbols) increased the axial force of the orbiter alone (square symbols) throughout the angle-of-attack range tested. The addition of the interstage hardware to the orbiter increased the orbiter axial force coefficient, and this may be attributed to the additional drag of the interstage hardware itself. The orbiter drag was decreased by the addition of the hardware to the tank, probably because the mutual interference between the orbiter and tank is decreased by the presence of the hardware.

As shown in page 4, the presence of the tank produced a negative increment in pitching moment coefficient, C_m , at negative angles of attack which decreased linearly with increasing angle of attack to zero at $\alpha = 4^\circ$. Adding the interstage hardware to either the orbiter or the tank produced an identical negative increment in C_m throughout the angle-of-attack range. As discussed previously in the paragraph on the lift coefficient, this would be expected because the effect of the presence of the interstage on the interference field between the orbiter and tank would be greater than the actual moment contribution of the hardware itself.

The effects of sideslip on the longitudinal aerodynamic characteristics of the orbiter (figures 5 and 6) were relatively small, and did not materially change the effects of the tank and interstage hardware from those at zero sideslip.

PRESENTATION OF DATA (Concluded)

The orbiter lateral-directional parameters C_y , C_n , and C_ℓ were affected to a small degree by the presence of the tank at $\beta = 0^\circ$ (page 6). The effects varied non-linearly with α , possibly because of the asymmetric tank configuration (the LOX feed line was on the right side of the tank). The presence of the interstage hardware produced a positive increment in C_y and a negative increment in C_n which indicated that the aft interstage structure might be the predominant element. The positive increment in C_ℓ appeared to be opposite from that expected on the basis of the increments in C_y and C_n , however, the rolling moments were probably due to an asymmetrical span loading rather than the loading on the interstage structure. The same trends in the lateral-directional parameters produced by the interstage structure are shown for $\beta = -6^\circ$ (figure 5, page 12) although the variation of the parameters with angle of attack was more linear than at $\beta = 0^\circ$. The same trends in C_y , C_n , and C_ℓ , although opposite in sign, were shown for $\beta = 6^\circ$ (figure 6, page 18). In both sideslip cases the effects of the interstage hardware on the orbiter lateral-directional characteristics were relatively small.

CONFIGURATIONS INVESTIGATED

Five configurations were investigated during this test. They were:
(refer to Figure 2f)

1. Integrated Vehicle - single sting
2. Integrated Vehicle - triple sting - no orbiter/external tank interstage attachment hardware
3. Integrated Vehicle - triple sting - orbiter/external tank interstage attachment hardware on orbiter
4. Integrated Vehicle - triple sting - orbiter/external tank interstage attachment hardware on external tank
5. Orbiter alone

Configuration 1, shown installed in the tunnel in Figure 3a, consisted of the orbiter (\emptyset), external tank (T) and solid rocket booster (S) all mated together with their appropriate attach hardware, or interstage attachment hardware (ISAH) as referred to herein, and supported on a single sting/balance which entered through the orbiter base region (Figure 2f). This arrangement therefore measured the aerodynamic loads prevalent on the entire integrated vehicle.

Configuration 2 consisted of the OTS configuration but with a triple sting mounting arrangement. The orbiter sting/balance was the same as configuration 1, but the external tank/solid rocket boosters as a unit were separated from the orbiter and the ISAH was missing. The TS unit was supported by twin stings which entered the base of each SRB (Figure

CONFIGURATIONS INVESTIGATED (Continued)

2f) and was non-metric. This arrangement therefore measured the aerodynamic loads on the orbiter in the presence of the TS stage with the interstage attachment hardware missing.

Configuration 3 was the same as configuration 2, with one exception. The ISAH missing in configuration 2 was added to the orbiter configuration. This arrangement therefore measured the aerodynamic loads on the orbiter with interstage attachment hardware, in the presence of the TS stage.

Configuration 4 was exactly like configuration 3, with one exception. The ISAH, attached to the orbiter in configuration 3, was removed from the orbiter and attached to the TS stage. This arrangement therefore measured the aerodynamic loads on the orbiter in the presence of the TS stage with the interstage attachment hardware present.

Configuration 5 simply measured the aerodynamic loads on the orbiter alone with the TS stage missing.

The model for the NASA LaRC 8-foot Transonic Pressure Test LA113 was a 0.010-scale replica of the Rockwell International Space Shuttle vehicle consisting of orbiter (O), external oxygen/hydrogen tank (T), and two solid rocket boosters (S). (Model 72-OTS).

CONFIGURATIONS INVESTIGATED (Continued)

The basic orbiter shown in Figure 2a was in accord with Rockwell International drawing VC70-000140C lines with the substitution of blunter VL70-08410 and VL70-8401 Orbital Maneuvering System (OMS) pods on the upper sidewalls of the fuselage afterbody and the elimination of the drag chute fairing from the vertical tail, reverting to the prior drawing, VL70-000146A. The fuselage was built to VL70-000140A lines, but the difference between this and the VL70-000140C is in the cut of the base region only, and the two are aerodynamically similar.

The orbiter was of blended wing body design having a double delta planform ($81^\circ/45^\circ \Lambda_{LE}$) 12% thick wing and full span elevons with six inch gaps between the independently deflectable inner and outer panels. A single swept ($\Lambda_{LEV} = 45^\circ$) centerline vertical tail with rudder and/or speedbrake capability was mounted between two OMS pods. A single body flap, to aid trim control during reentry from orbit was fitted on the lower trailing edge of the fuselage. The rudder, speedbrake and body flap were not deflectable on this model and were preset to 0° . Unshielded Reaction Control System (RCS) thrusters were provided in the nose and on the rear of the OMS pods.

The orbiter was fabricated with a 7076-T6 aluminum fuselage as the principal structure, with aluminum OMS pods, aluminum vertical tail and Armco steel wing appended thereto.

CONFIGURATIONS INVESTIGATED (Continued)

The wings were originally designed for and used on Model 75-0, a plume model. They were fitted to the 72-0 fuselage. The right hand wing was made with the panel integral with a three component strain gauged beam to allow root bending moment, root torsion moment and panel normal force to be measured. Wing loads were not measured during this test, however.

The left hand wing panel was rigidly attached to the fuselage of the orbiter, but was provided with a plain, bearing hinged, deflectable elevon with the inner and outer panels supported in torsion by individual strain gauged beams to allow hinge moments to be obtained. The elevon was made with a cylindrical section lower gap and a conical section upper gap with centerlines on the elevon hingeline so that the elevon gap will remain constant with deflection. No attempt was made to simulate the elevon flipper doors. The elevon-deflections were individually set by discrete brackets which attach to the elevon panel and the gauged beam with a .066" square pin through the bracket and the beam, with the angle of the square hole in the bracket determining the deflection. Elevons were set at $10^{\circ}/4^{\circ}$ inboard/outboard deflection respectively, throughout this test and hinge moments were not recorded. To provide similar model aeroelastic characteristics on both wings, the elevon arrangement on the right hand wing was identical to the left hand, but the beams were not gauged.

CONFIGURATIONS INVESTIGATED (Continued)

Interstage attachment hardware can be mounted on the bottom of the orbiter. Off blocks are provided for when the attachment hardware is either off or mounted on the external tank.

The External Tank was in accord with Rockwell International drawing VC78-000002 for general configuration and was built to the outside skin line which includes the spray-on foam insulation (SOFI). It was 333" cylindrical cross section with a biconic liquid oxygen vent valve housing on the front of the 612" tangent ogive nose. The longeron hat stiffness sections between the oxygen and hydrogen portions of the tank were not simulated.

This tank was the same article as tested in NASA series IA93, reference 2, with no change in protuberances, lines and fairings. A scaled front and rear orbiter/ET attach strut was used. The general arrangement of the External Tank is shown in Figure 2c.

The tank was composed of four major aluminum pieces, to which were attached the external plumbing and protuberances. Six pockets were milled in the shell for SRB and orbiter attachment hardware. Dummy interstage attachment hardware to the orbiter was provided, along with off block to fill the pockets when the attachment hardware was missing.

The Solid Rocket Boosters were modified to conform to Rockwell International drawing ICD 2-000001 3. The SRB's were of 146" diameter cylindrical

CONFIGURATIONS INVESTIGATED (Continued)

cross section having an 18° conical nose with a spherical leading edge. A 20° flared base with load-bearing stiffeners was provided to support the entire vehicle on the launch pad and to shield the rocket motor nozzle.

The SRB's were the same or identical, depending on sting configuration articles as tested in reference 2, with the same separation motors, conduits and fairings. The general layout of the SRB's is shown in Figure 2d.

The SRB's provided were made of aluminum alloy with aluminum, solder, and Armco protuberances. The protuberances are not removable. The SRB's were supported through the base and sting mounted on the internal dummy balance block.

The integrated vehicle geometry is shown in figure 2b. The model was mounted upright in the tunnel as shown in figure 3a.

Following is a complete list of individual components present on each model element.

O - 140A/B/C/R Orbiter (Figure 2a)

B₇₀ Orbiter Fuselage, per VL70-000193, -000140A, VL70-000140B.

C₉ Canopy, per VL70-000140A, VL70-000143A.

F₁₀ Bodyflap per VL70-000140B, VL70-000200.

CONFIGURATION INVESTIGATED (Continued)

M₁₆ OMS Pods, per VL70-000203, VL70-008401, VL70-008410.
N₈₉ OMS Nozzles, per VL70-008401.
W₁₂₇ Wing, per VL70-000140C, VL70-000200B.
E₅₂ Elevons, VL70-000203, VL70-000140C.
V₈ Vertical tail, per VL70-000140A, VL70-000146A.
R₅ Rudder, per VL70-000095.

T - Modified Vehicle 5 External Tank (Figure 2c)

T₃₅ Modified Vehicle-5, External Tank Body.
FL₁₀ LH₂ feedline per VL78-000063, VL78-000062B, VC78-000002.
FL₁₁ LO₂ feedline per VL78-000063, VL78-000062B, VC78-000002.
PT₂₉ Forward electrical line per VL78-000063, VC78-000002.
PT₂₃ LO₂ recirculation line per VL78-000063, VL78-000062B,
Martin-Marietta 82600207000, VC78-000002
PT₂₅ Aft electrical line per VL78-000063, VL78-000062B, Martin-
Marietta 82600207000, VC78-000002.
PT₂₆ LO₂ pressure line, per VL78-000063, VL78-000062B, Martin-
Marietta 82600207000
PT₂₉ Electrical conduit, per ICD-2-00001, Rev. B.
PT₃₃ LH pressure line per ICD-2-00001, Rev. B.
AT₂₈ Attach structure, per VL78-000063, VL78-000062B.
AT₁₃₁ Attach structure, per ICD-2-00001, Rev. B.
AT₃₀ Attach structure, per VL78-000066, 82600207000,
VC78-000002.
AT₃₁ Attach structure, per VL78-000063, VL78-000062B,
VL78-000066, VC78-000002.

CONFIGURATIONS INVESTIGATED (Continued)

AT₁₃₀ Forward O/T attach structure, per ICD-2-00001, Rev. B.
FR₁₀ Fairing, per VL78-000063, VL78-000062B, Martin-Marietta
82600207000, VC78-00002.
PT₃₉ ET nose probe, per ICD-2-00001, Rev. B.

S - Modified Vehicle 5 Solid Rocket Booster (Figure 2d)

S Modified vehicle -5 Solid Rocket Boosters.

S₂₄ Modified Vehicle -5 Solid Rocket Booster Body.

N₁₀₆ SRB nozzles, per VL77-000066, VC77-000002A.

PS₂₀ Electrical tunnel, per ICD-2-00001, Rev. B.

PS₂₆ Aft attach ring, SRB, per ICD-2-00001, Rev. B

PS₃₃ Three Intermediate Structural Rings, per ICD-2-00001,
Rev. B.

PS₃₅ Aft structural ring, per ICD-2-00001, Rev. B.

PS₂₃ Forward separation motors, per ICD-2-00001, Rev. A.

PS₂₈ Aft Separation Motor Fairing, per ICD-2-00001, Rev. B.

PS₂₉ Tiedown struts, per ICD-2-00001, Rev. B.

PS₃₆ Aft separation motors, per ICD-2-00001, Rev. B.

PS₃₄ Aft cable housing, per ICD-2-00001, Rev. B.

PS₃₂ Data capsule and camera, SRB.

PS₃₁ Command antennae, SRB.

PS₃₀ APU exhaust outlets, SRB.

PS₂₇ SRM nozzle actuator struts.

FR₁₄ ET nose cable fairing.

FR₁₅ ET nose fairing for PT₃₉.

CONFIGURATIONS INVESTIGATED (Concluded)

- FR₁₆ LO₂ feedline (FL11) fairing.
- FR₁₇ LO₂ antigeyser-line (PT23) fairing.
- FR₁₈ Aft electrical-conduit (PT25) fairing.
- FR₁₉ LH pressure-line (PT33) fairing.

TEST FACILITY DESCRIPTION

NASA/Langley Research Center 8-foot Transonic Pressure Tunnel is an air-medium facility capable of attaining continuously variable Mach numbers from 0.20 to 1.30. It is a single-return, closed-circuit tunnel having controlled stagnation temperature, total pressure and dew-point temperature. The test section is 7.1 feet square. Reynolds numbers are variable from $0.30 \times 10^6/\text{ft}$ to $7.0 \times 10^6/\text{ft.}$, depending on Mach number and tunnel total-pressure limitations. Models are supported in the test section by a sting-sector system, but wall-mounting is possible. Schlieren photography is available for flow and shock-wave studies.

DATA REDUCTION

Langley Research Center standard data reduction procedures were utilized to calculate aerodynamic coefficients in the body and stability axis systems. No corrections have been applied to the data for base effects.

Force coefficients are based on a wing planform area of 2690 square feet. Moments are calculated about a reference center of gravity located at external tank station 976, butt line 0, and water line 400, (see Figure 2b) and use the orbiter length of 1290.3 inches as a non-dimensionalizing factor.

Base pressure coefficients were calculated by:

$$C_{p_i} = \frac{P_{bi} - P_{\infty}}{q_{\infty}}$$

where (i) = 1 thru 7 and represents some manifolding of pressure orifices. Referring to Figure 2e:

P_{b1} = taps 1, 2, and 3 (orbiter base region)

P_{b2} = taps 4a, 4b and 4c (body flap upper surface)

P_{b3} = taps 5 and 6 (OMS pod region)

P_{b4} = 2 taps in balance cavity manifolded together

P_{b5} = taps 7, 8, 9, 10, 11 (LH SRB base region)

P_{b6} = taps 12, 13, 14, 15, 16 (ET base region)

P_{b7} = tap 17 (ET base region)

REFERENCES

1. Marroquin, John, "Results of Tests of the 0.010-Scale Space Shuttle Integrated Vehicle in the Langley Research Center 8-foot Transonic Pressure Tunnel, Model 72-OTS Test IA244" DMS-DR-2391, NASA CR 167,346, December 1981.
2. Nichols, M. E., Hawthorne, P. J., Hamilton, J. T., and Miller, P. K., "Results of Investigations Conducted in the LaRC 8-foot Transonic Pressure Tunnel Using the 0.010-Scale 72-OTS Model of the Space Shuttle Integrated Vehicle (IA93)". DMS-DR-2326, NASA, CR-151,037 and 038 (2 Volumes) February 1977.

TABLE I

TEST : LA113

DATE : POST TEST

TEST CONDITIONS

BALANCE UTILIZED: LaRC #840

CAPACITY:

ACCURACY:

COEFFICIENT TOLERANCE:

NE 800 lb.

SE 250 lb.

AF 125 lb. 1b.

PM 1600 in-1b

RM 500 in-lb

YM 500 in-1b

COMMENTS:

TABLE II

TEST : LA113 (8FT TPT 787)		DATA SET/RUN NUMBER COLLATION SUMMARY							DATE : 8/22/77														
DATA SET IDENTIFIER	CONFIGURATION	PARAMETERS					CONFIG.	MACH NUMBER															
		α	β	S_{Ez}	S_{Eq}	RN/L		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
* RKH01	ϕ TS (1 string)	A	0	10	4	3.98	1																
02		T	6	—	—	—	—																
03		—	-6				—																
04	ϕ alone (1 string)	0			3.36		5																
05		—	6				—																
06		—	-6				—																
07	ϕ TS (no hardware)	0					2																
08		—	6				—																
09		—	-6				—																
10	ϕ TS (hardware on ϕ)	0					3																
11		—	6				—																
12		—	-6				—																
13	ϕ TS (hardware on T)	0					4																
14		—	6				—																
15		—	-6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

1 7 13 19 25 31 37 43 49 55 61 67 75 76

α OR β
SCHEDULES

A) -8° to 4° , $\Delta\alpha = 2^{\circ}$

COEFFICIENTS

IDVAR (1) IDVAR (2) NDV

* See next page for coefficient schedules

TEST RUN NUMBERS

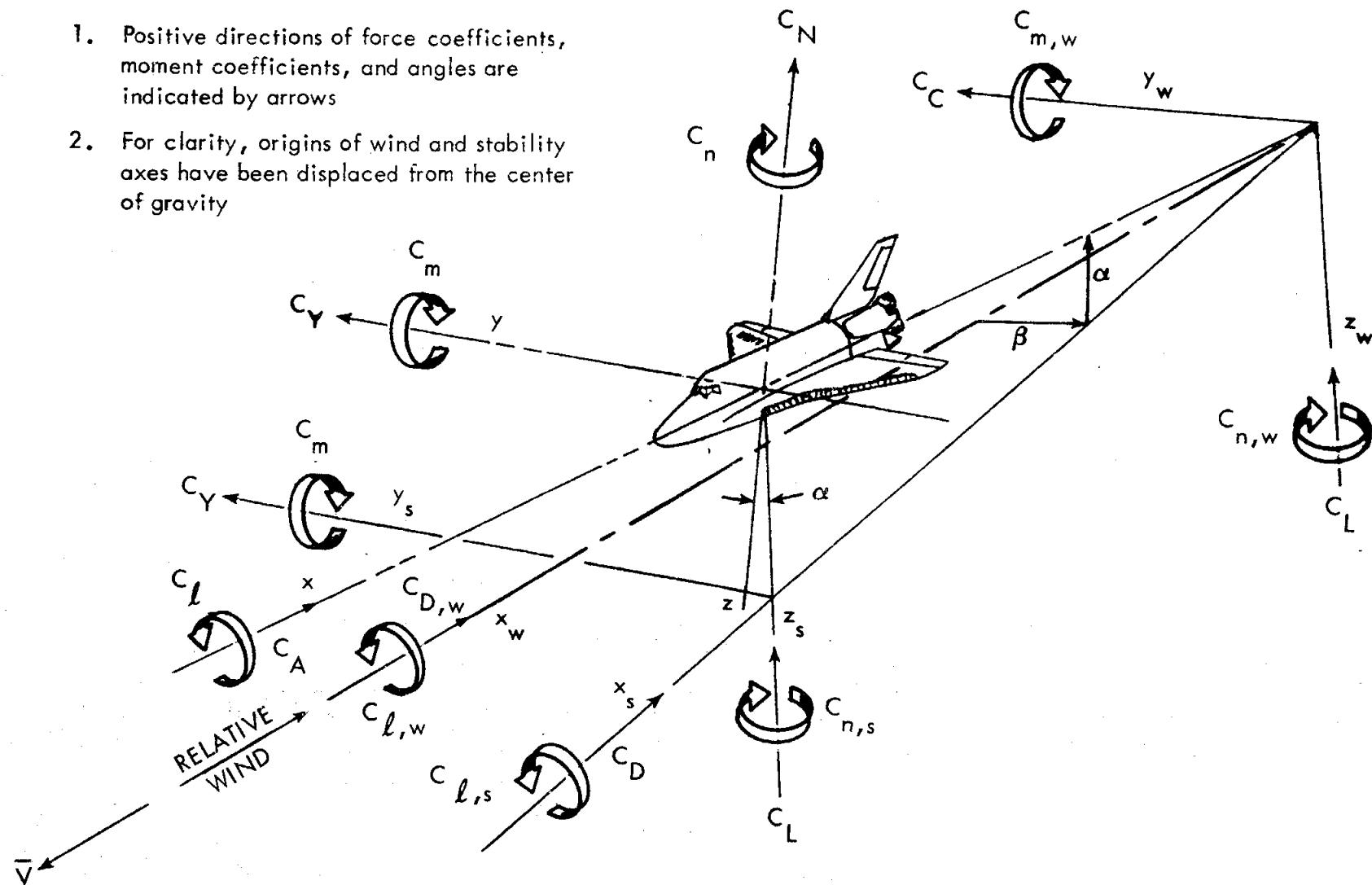
DMS 710

TABLE II (Concluded)

<u>Data Set 1st Character</u>	<u>Independent Variables</u>	<u>Dependent Variables</u>									
R	MACH/ALPHA	BETA	CN	CA	CLM	CBL	CYN	CY	CL	CD	L/D
S (1-3)	MACH/ALPHA	CPB1	CPB2	CPB3	CPB4	CPB5	CPB6	CPB7	RN/L	Q(PSF)	
S (4-15)	MACH/ALPHA	CPB1	CPB2	CPB3	CPB4	RN/L	Q(PSF)				

Notes:

1. Positive directions of force coefficients, moment coefficients, and angles are indicated by arrows
2. For clarity, origins of wind and stability axes have been displaced from the center of gravity



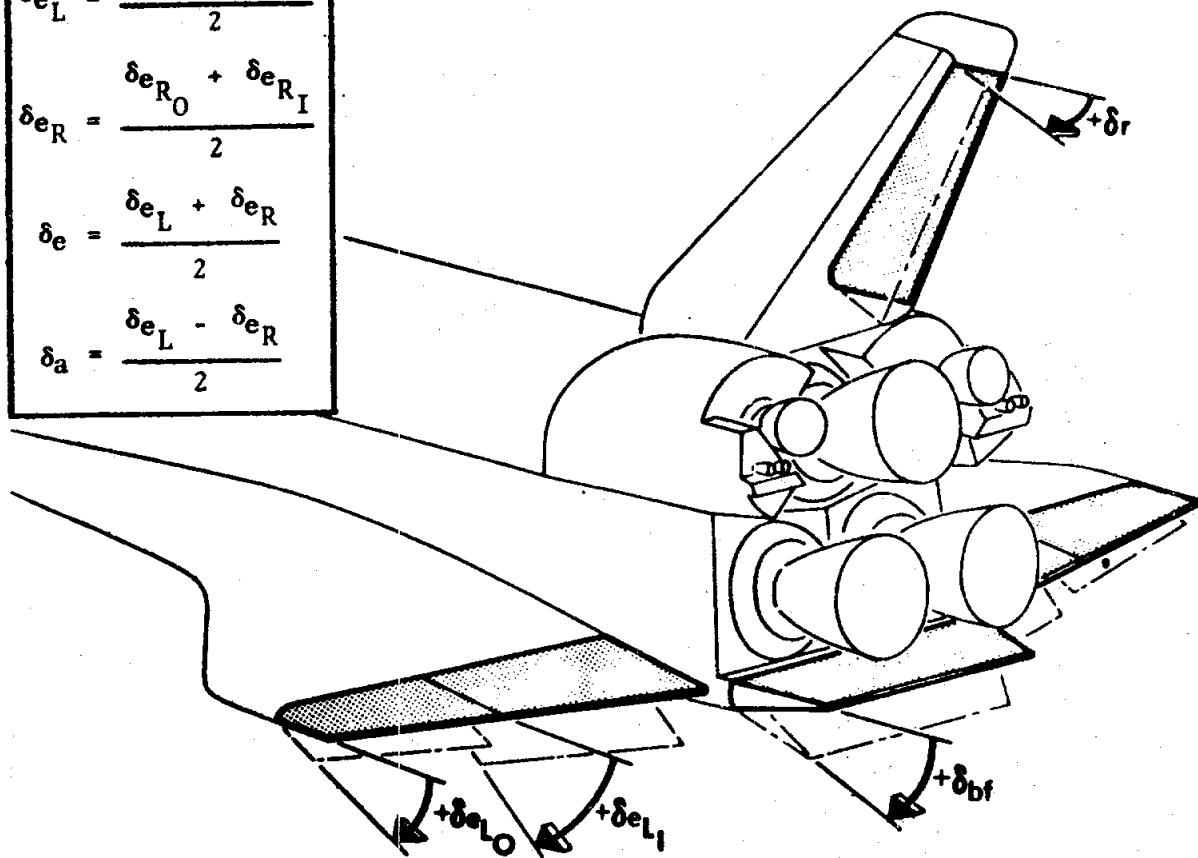
a) Axes Systems
Figure 1. Model Axes Systems and Sign Conventions

$$\delta e_L = \frac{\delta e_{L_0} + \delta e_{L_I}}{2}$$

$$\delta e_R = \frac{\delta e_{R_0} + \delta e_{R_I}}{2}$$

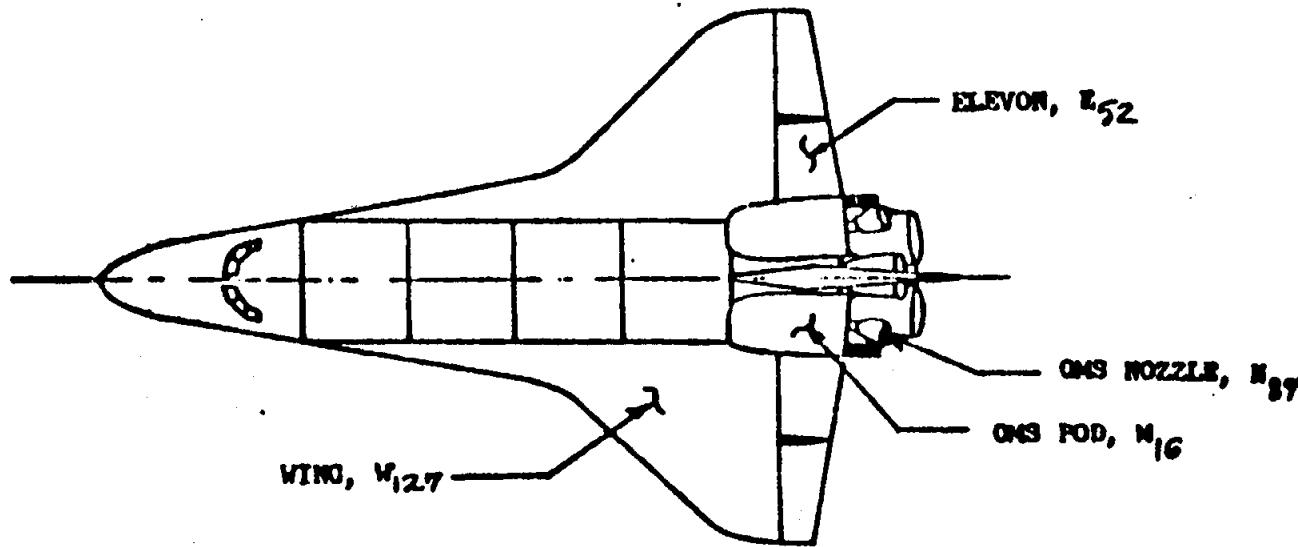
$$\delta e = \frac{\delta e_L + \delta e_R}{2}$$

$$\delta_a = \frac{\delta e_L - \delta e_R}{2}$$

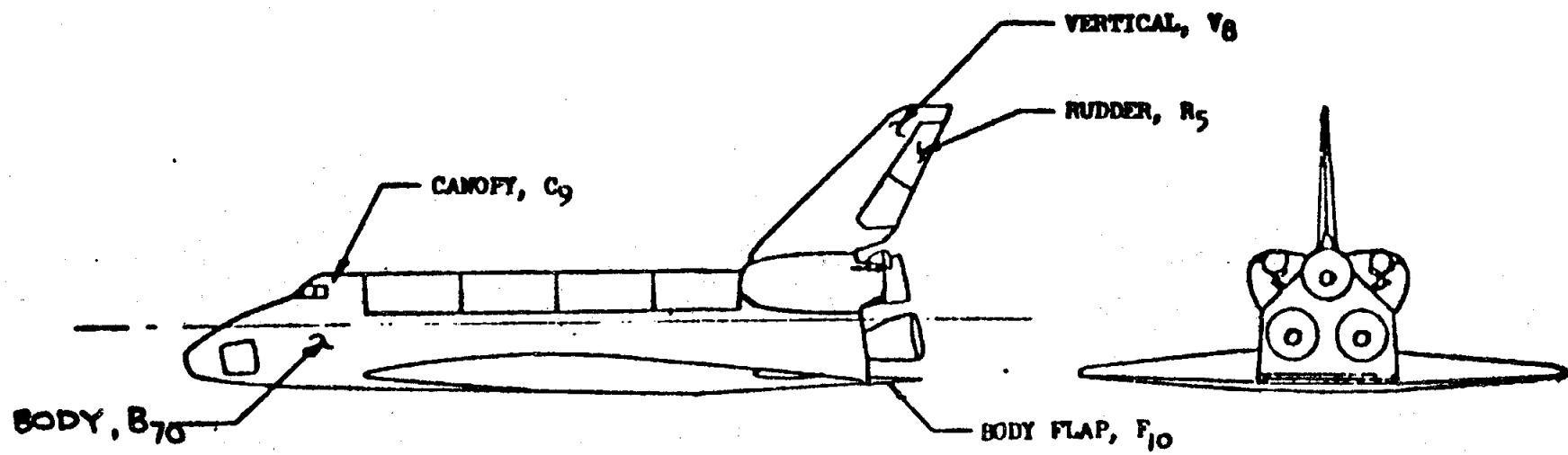


Positive Deflection of	Angle	Aero Forces and Moments	Hinge Moment
Rudder, δ_r	$+ \beta, -\psi$	$+C_Y, -C_n$	$-C_{h_r}$
Elevon, δ_e	$-\alpha, -\theta$	$-C_m$	C_{h_e}
Right, δe_R	$-\phi$	$-C_l$	$-C_{h_e_R}$
Left, δe_L	$+\phi$	$+C_l$	$-C_{h_e_L}$
Aileron, δ_a	$+\phi$	$+C_l$	
Body Flap, δ_{bf}	$-\alpha, -\theta$	$-C_m$	$-C_{h_{bf}}$

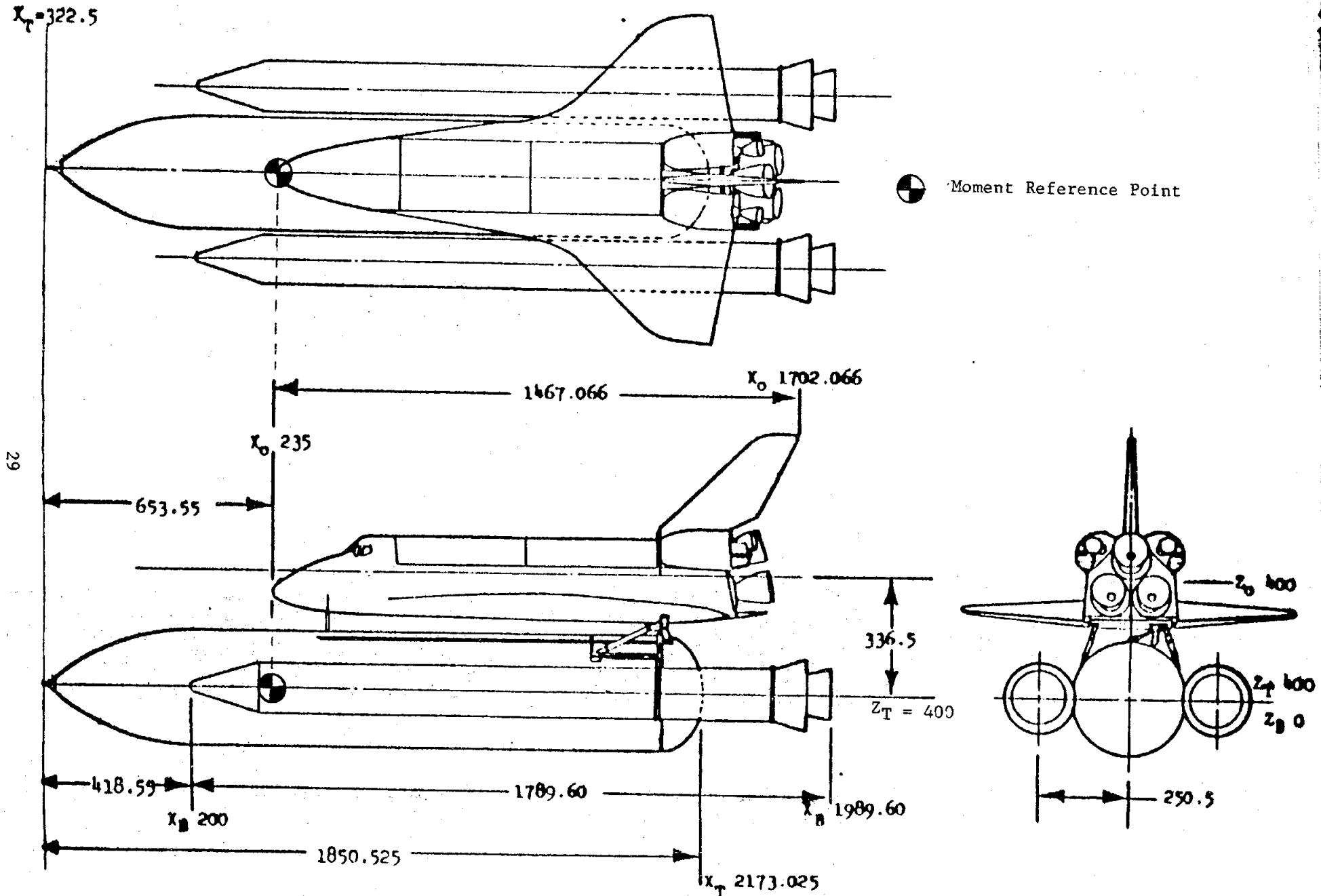
b) Control Surface Sign Convention
Figure 1. Concluded



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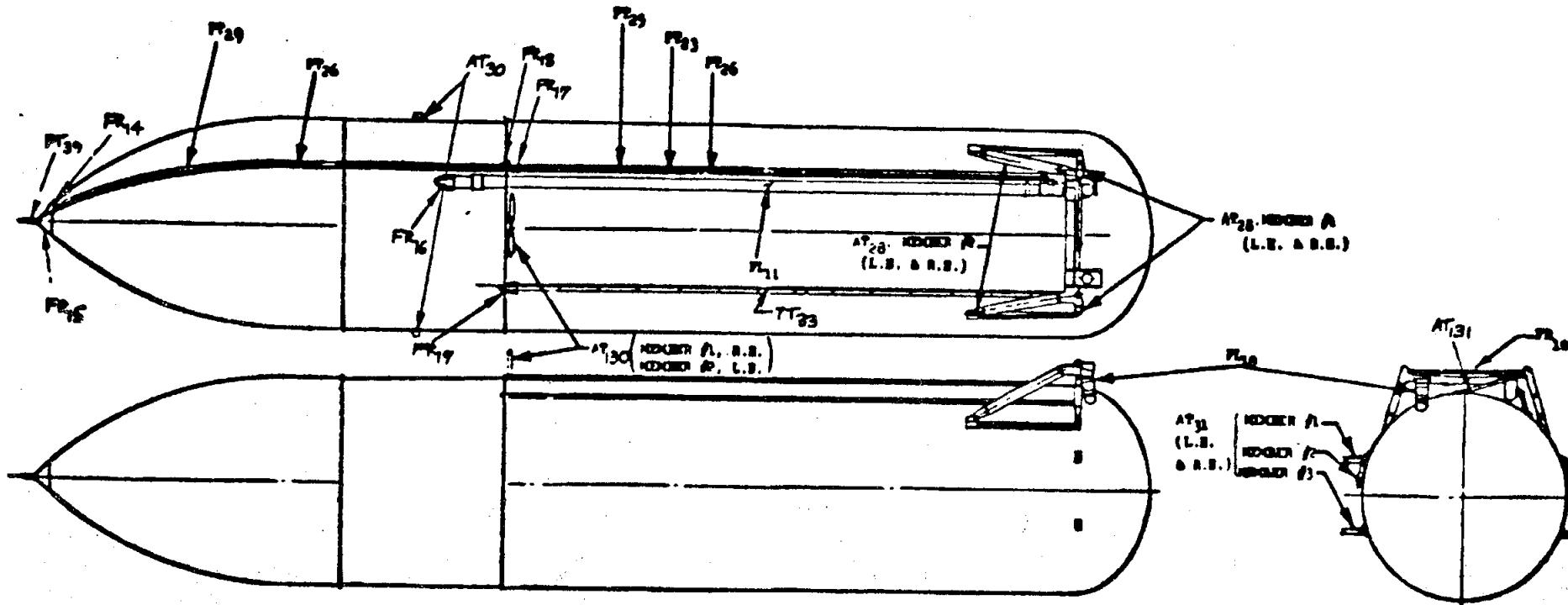


a. Orbiter Three-View
Figure 2. Model Sketches

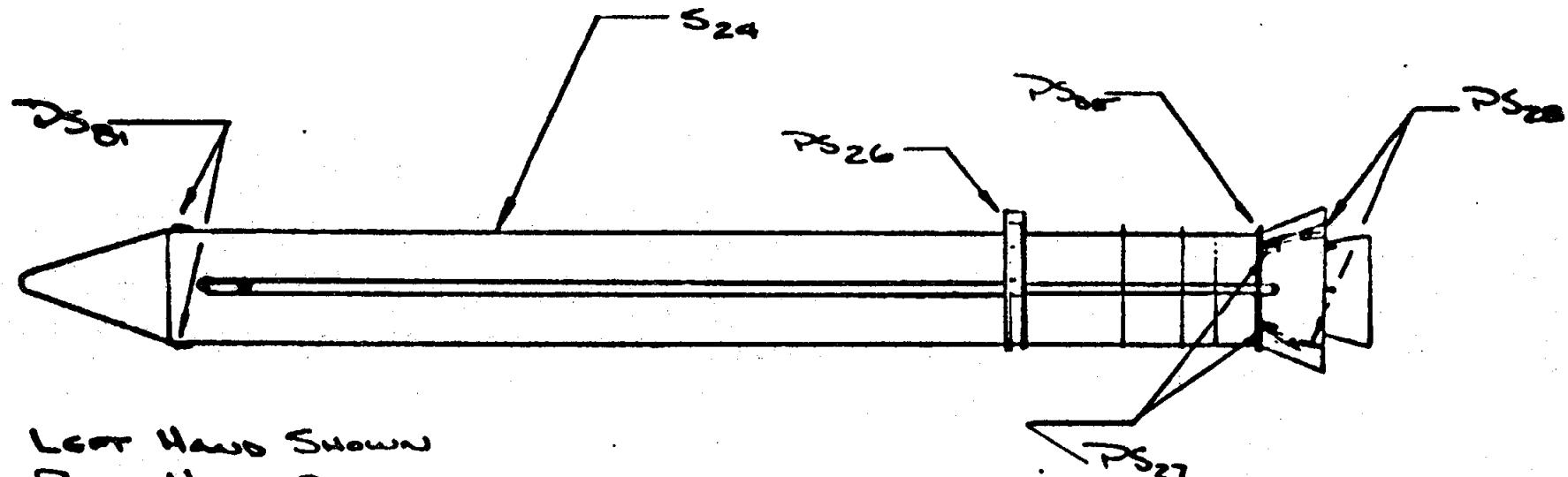
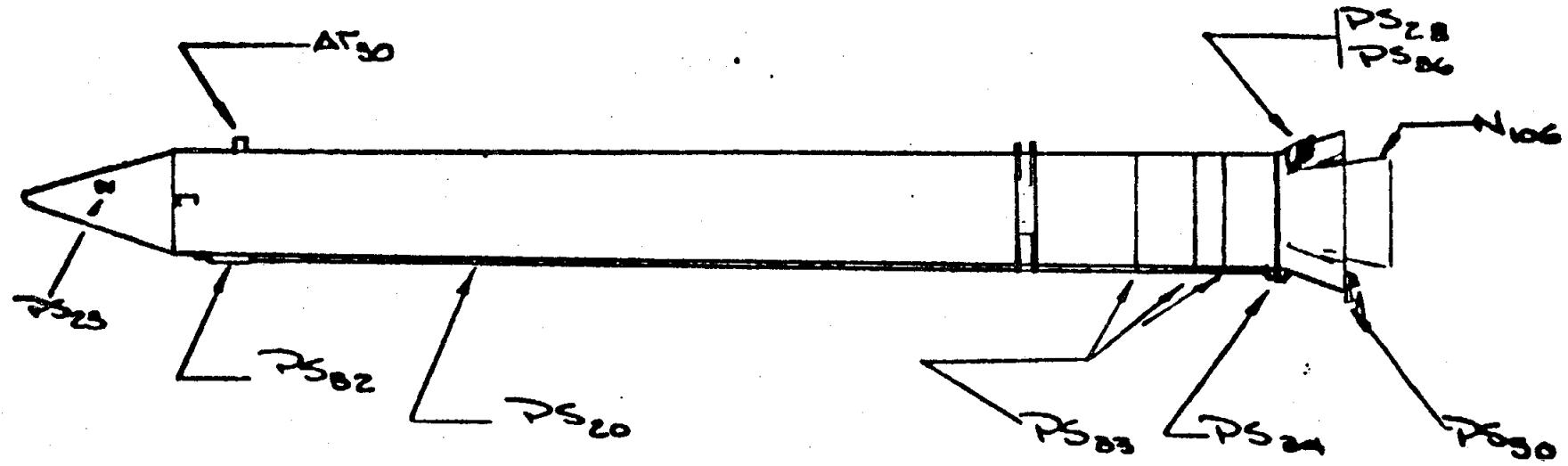


b. Integrated Vehicle - Three View

Figure 2. Continued

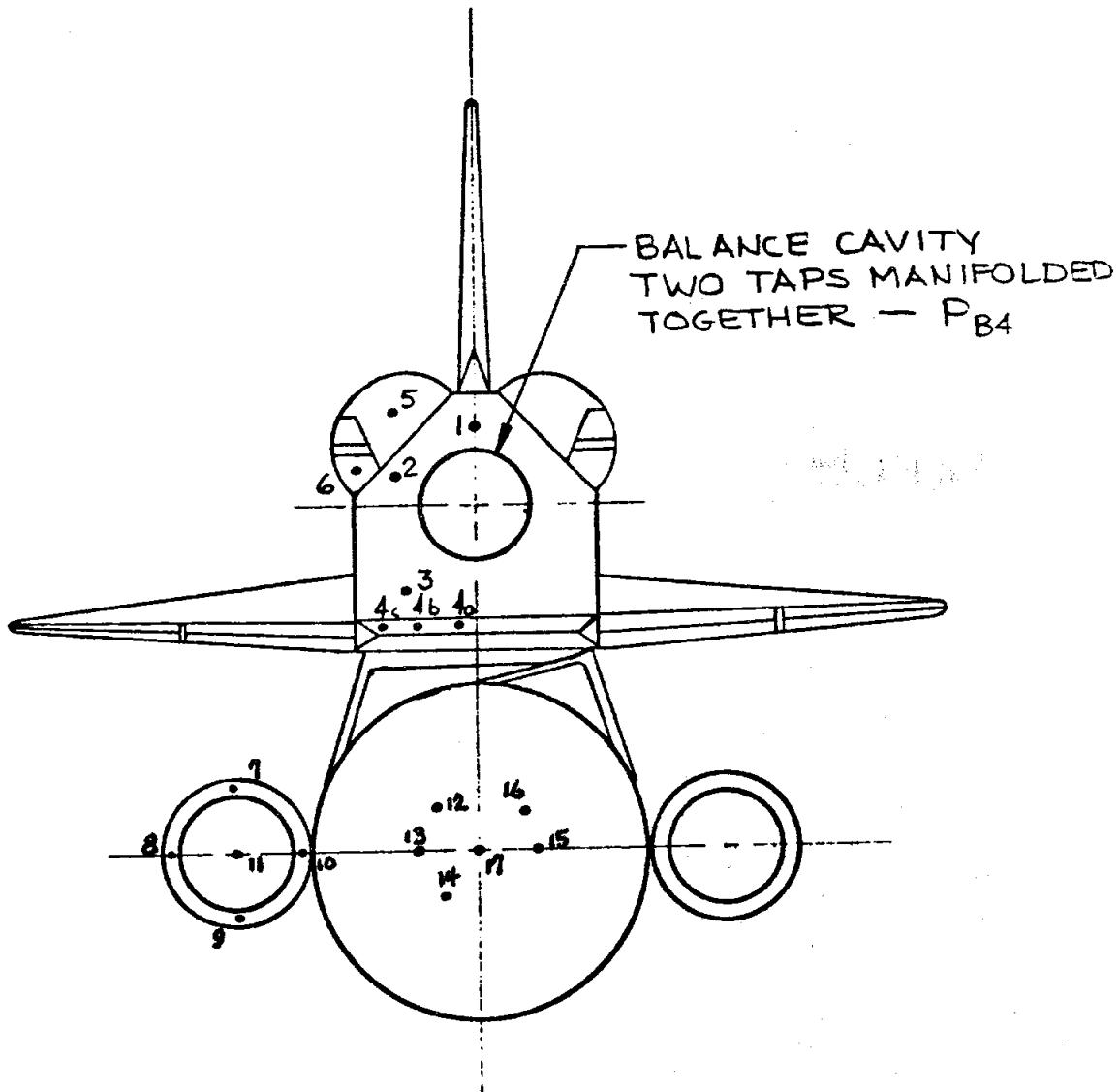


c. External Tank with Protuberances
Figure 2. Continued



Left Hand Shown
Right Hand Opposite

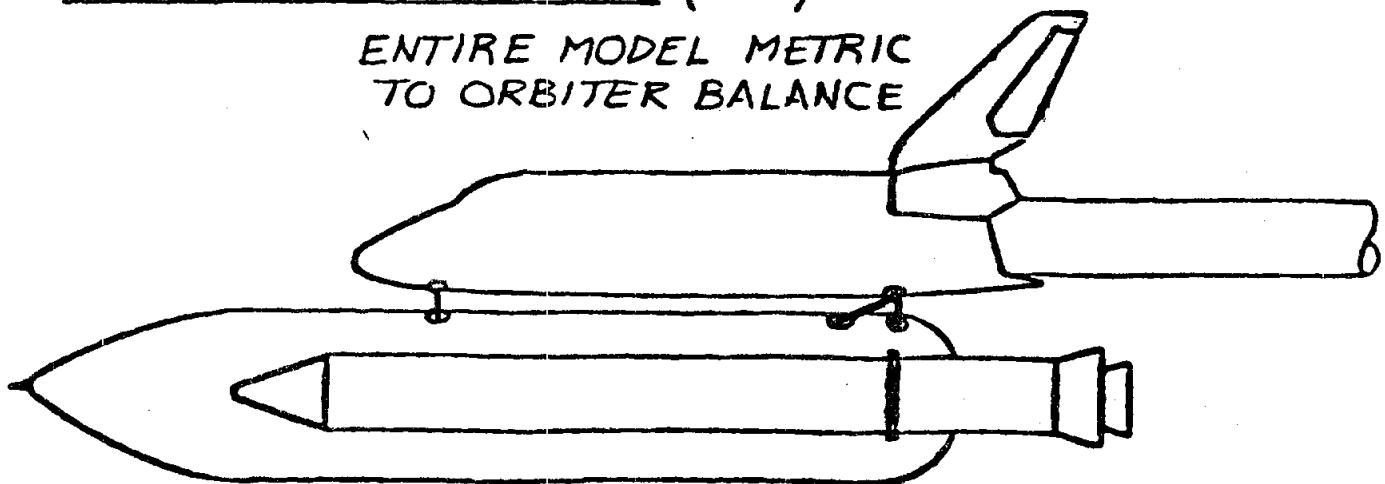
d. Solid Rocket Booster with Protuberances
Figure 2. Continued



e. Base Pressure Tap Layout
Figure 2. Continued

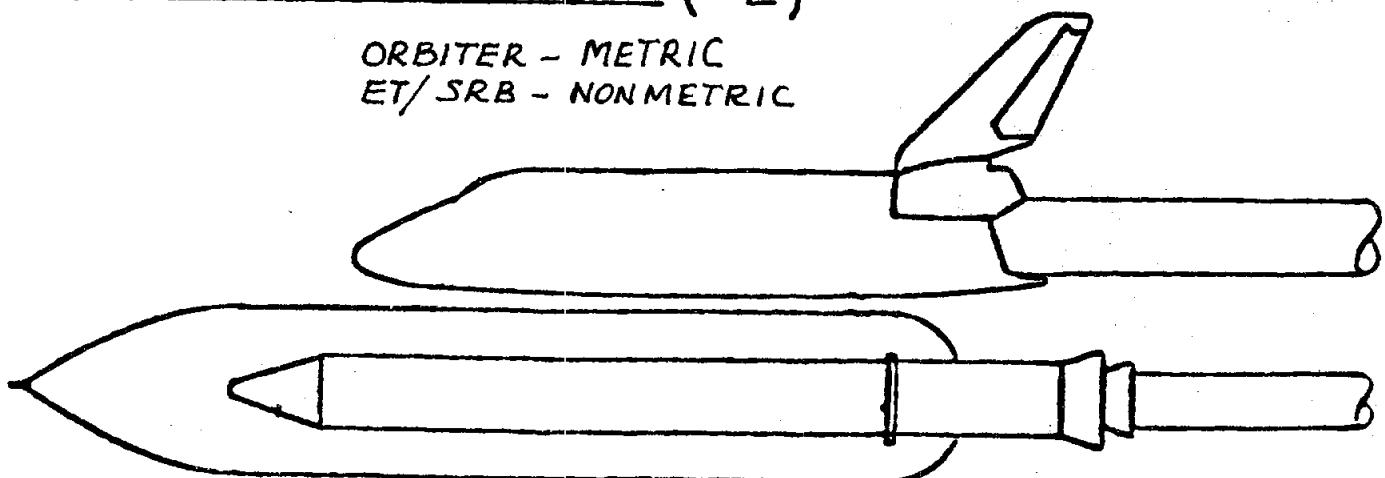
CONFIGURATION OTS (#1)

ENTIRE MODEL METRIC
TO ORBITER BALANCE



CONFIGURATION OTS (#2)

ORBITER - METRIC
ET/ SRB - NON METRIC

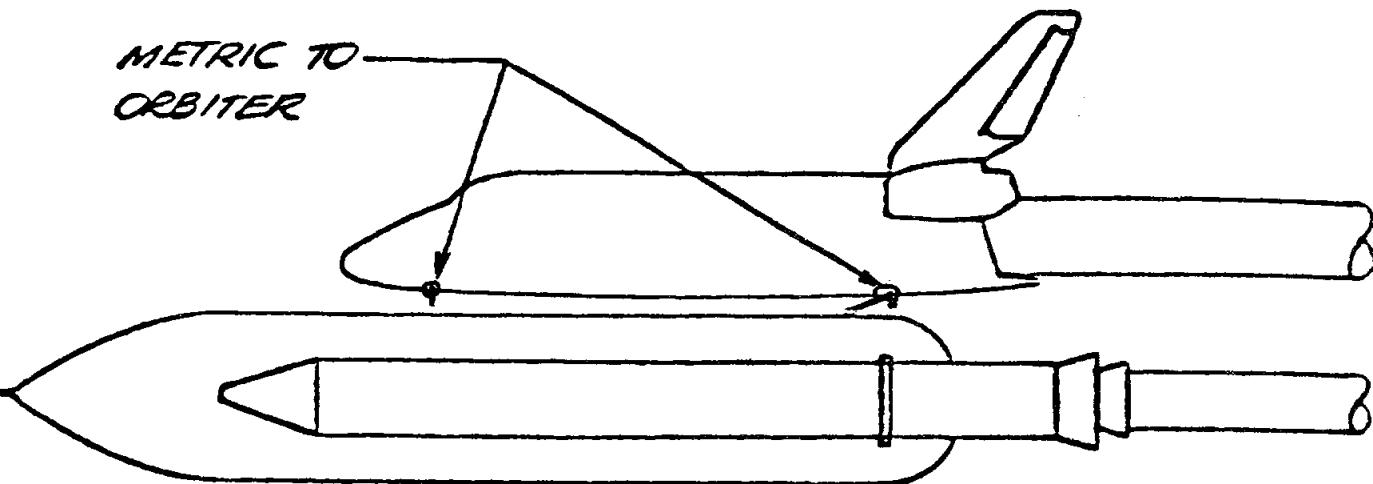


f. Configuration Definitions
Figure 2. Continued

CONFIGURATION OTS (#3)

BALANCE IN ORBITER ONLY

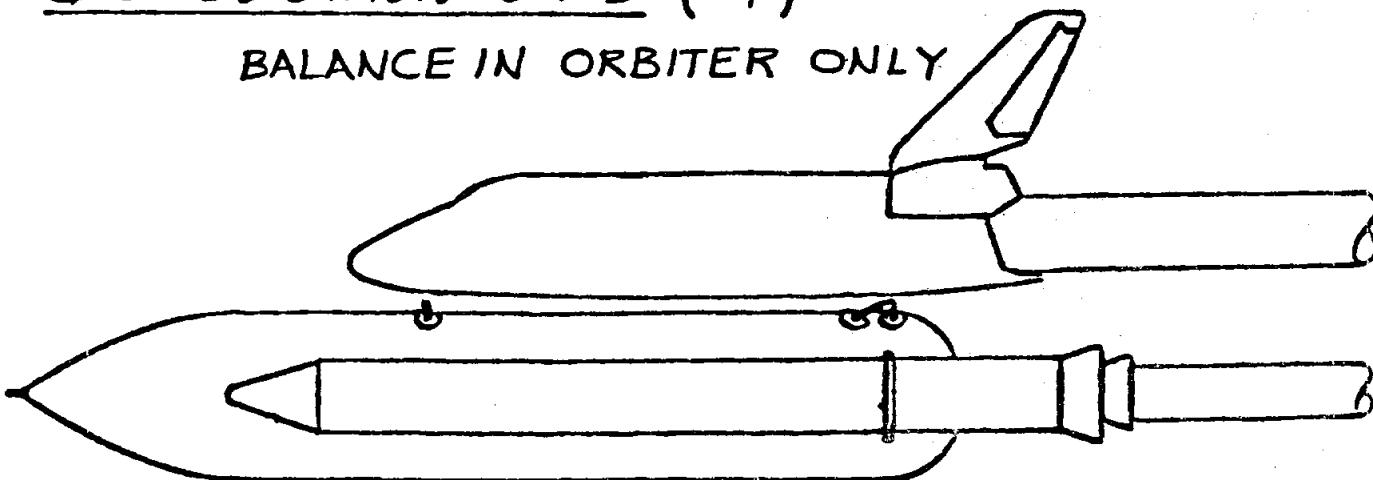
METRIC TO
ORBITER



ET & SRB's NON-METRIC

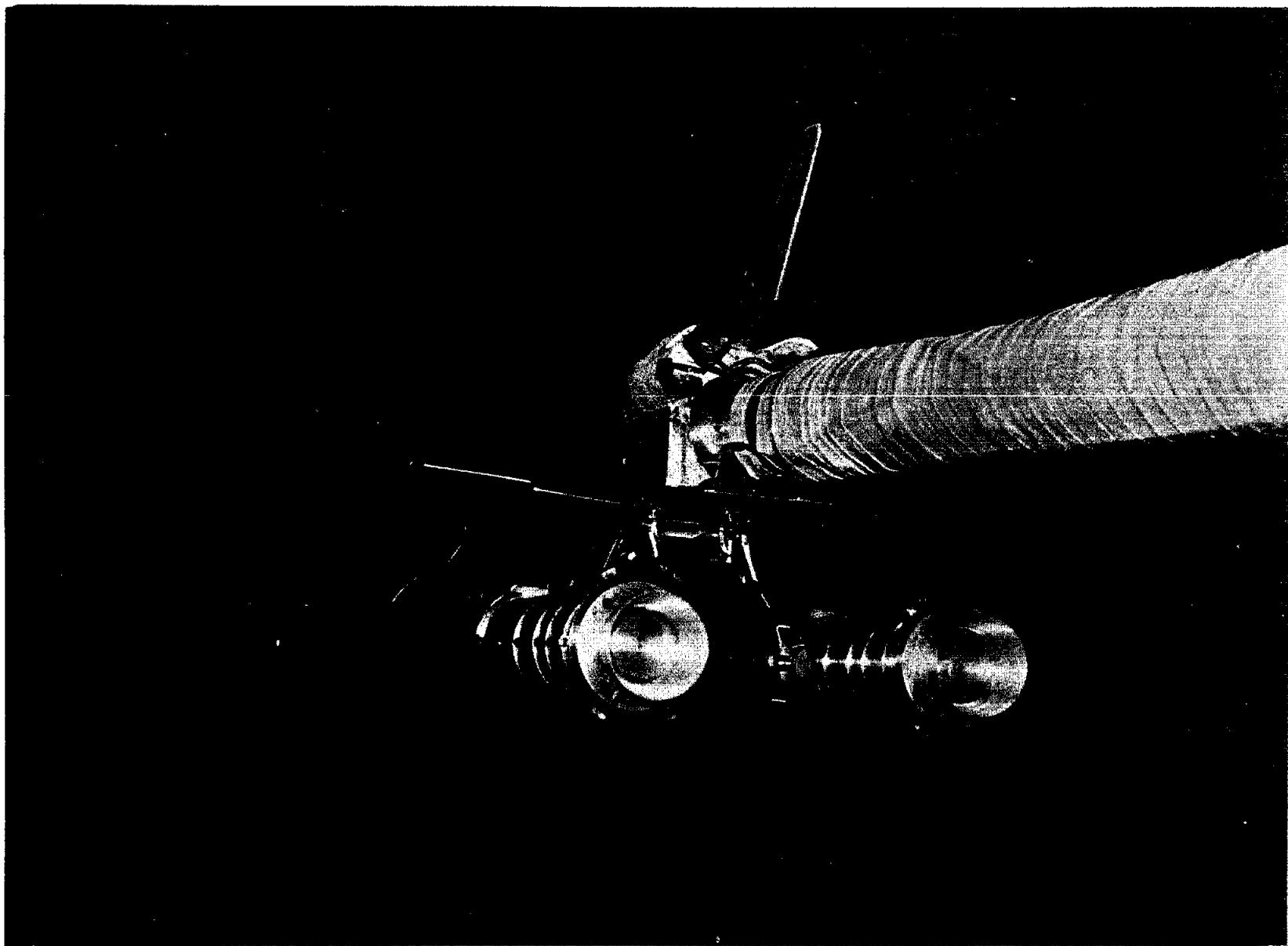
CONFIGURATION OTS (#4)

BALANCE IN ORBITER ONLY

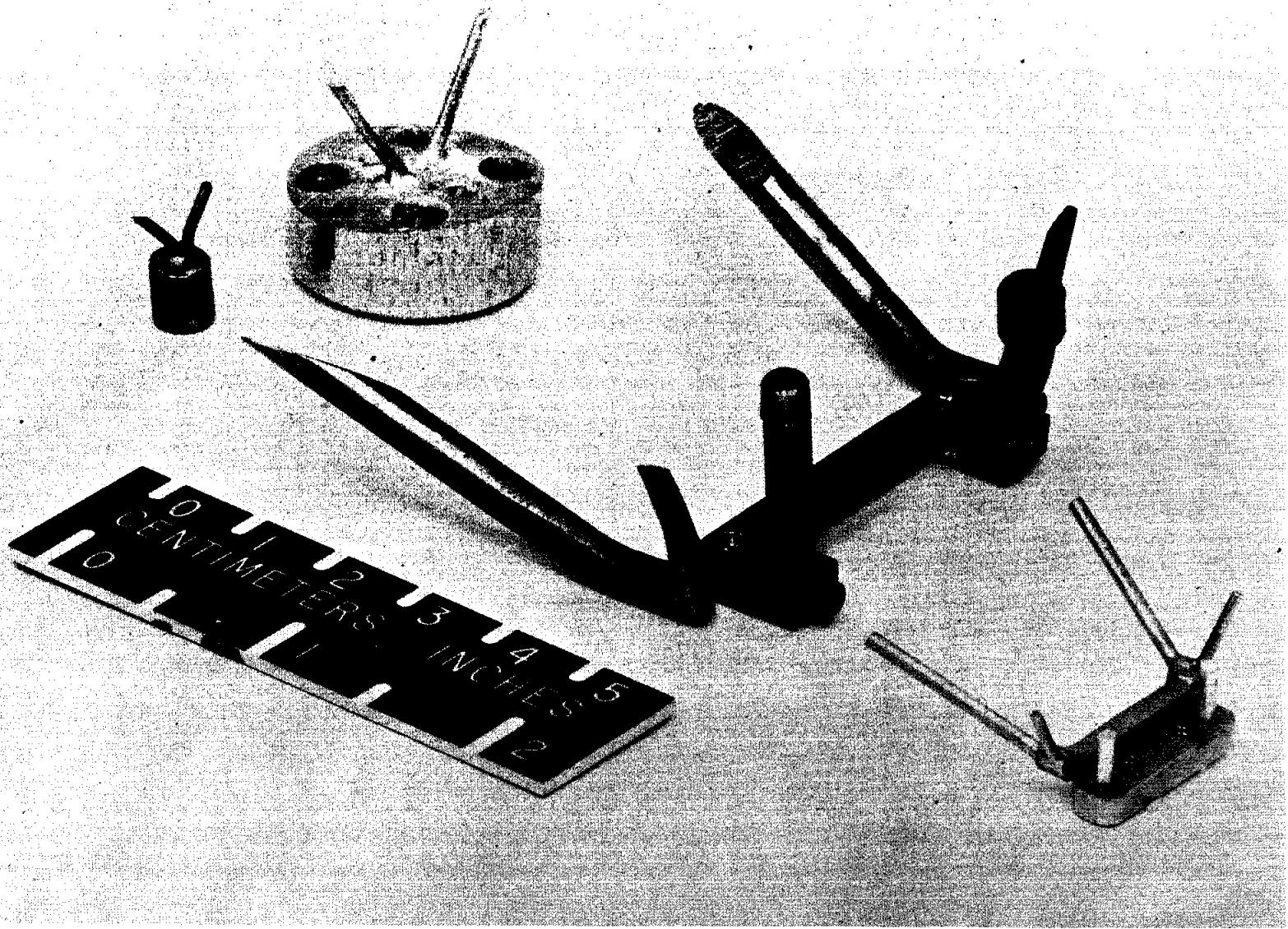


ET, SRB's & ATTACH STRUCTURES NON-METRIC

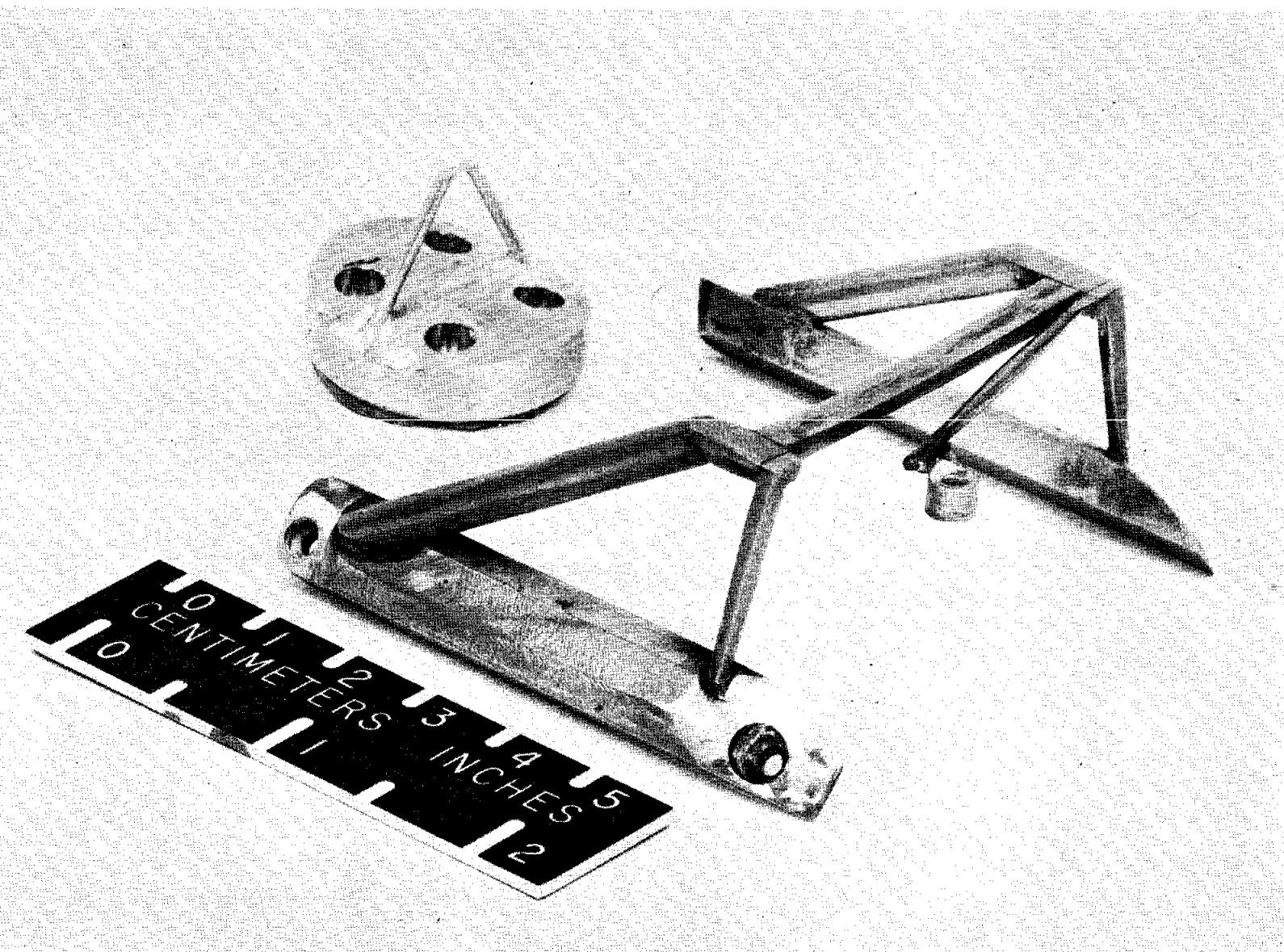
f. Configuration Definitions
Figure 2. Concluded



a. Configuration 1 Installation
Figure 3. Model Photographs



b. Attachment Hardware Applied to Tank
Figure 3. Continued



c. Attachment Hardware Applied to Orbiter
Figure 3. Concluded

DATA FIGURES

Tabulations of plotted data figures may be found in the appendix.

DATA SET SYMBOL

RKH001 O LARC BFT TPT 787(LA113) INTEGRATED VEH..1 STING
 RKH004 □ LARC BFT TPT 787(LA113) ORBITER ALONE
 RKH007 ◇ LARC BFT TPT 787(LA113) ORB.NEAR TANK,NO HDWRE
 RKH010 △ LARC BFT TPT 787(LA113) ORB.NEAR TANK,HDWR ON OB
 RKH013 ▽ LARC BFT TPT 787(LA113) ORB.NEAR TANK,HDWR ON TK

CONFIGURATION

BETA 1B-ELV OB-ELV
 .000 10.000 4.000
 .000 10.000 4.000
 .000 10.000 4.000
 .000 10.000 4.000

REFERENCE INFORMATION
 SREF 2690.0000 SO.FT.
 LREF 1290.3000 INCHES
 BREF 1290.3000 INCHES
 XMRP 976.0000 IN. XT
 YMRP .0000 IN. YT
 ZMRP 400.0000 IN. ZT
 SCALE .0100

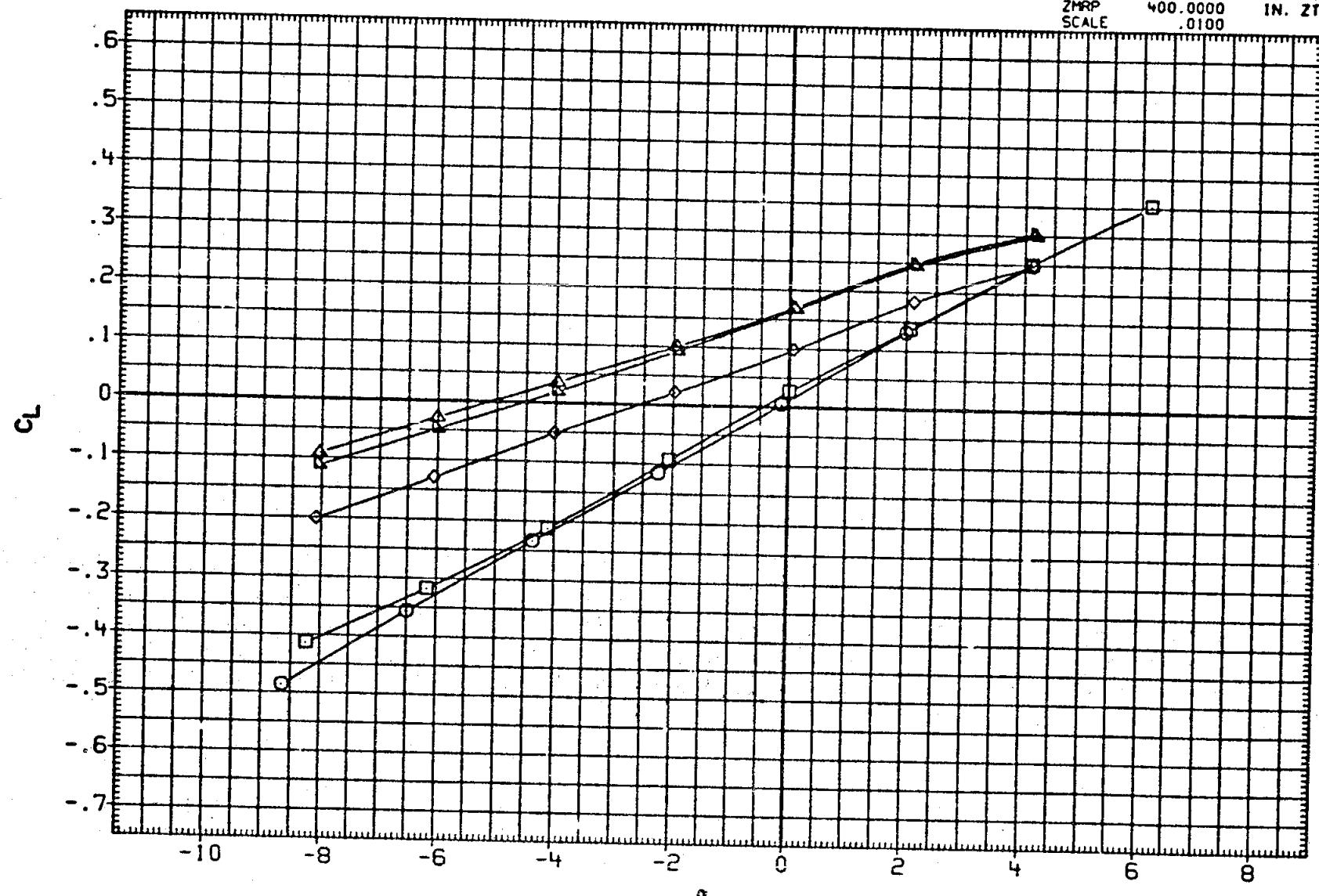


FIGURE 4. VEHICLE AERODYNAMIC CHARACTERISTICS, BETA=0 DEGREES

(A) MACH = .90

DATA SET SYMBOL	CONFIGURATION	BETA	IB-ELV	OB-ELV	REFERENCE INFORMATION
RKH001	○ LARC BFT TPT 787(LA113) INTEGRATED VEH.,1 STING	.000	10.000	4.000	SREF 2690.0000 SO.FT.
RKH004	□ LARC BFT TPT 787(LA113) ORBITER ALONE	.000	10.000	4.000	LREF 1290.3000 INCHES
RKH007	◇ LARC BFT TPT 787(LA113) ORB.NEAR TANK,NO HOWRE	.000	10.000	4.000	BREF 1290.3000 INCHES
RKH010	△ LARC BFT TPT 787(LA113) ORB.NEAR TANK,HOWR ON OB	.000	10.000	4.000	XMRP 976.0000 IN. XT
RKH013	■ LARC BFT TPT 787(LA113) ORB.NEAR TANK,HOWR ON TK	.000	10.000	4.000	YMRP .0000 IN. YT
				ZMRP 400.0000 IN. ZT	
				SCALE .0100	

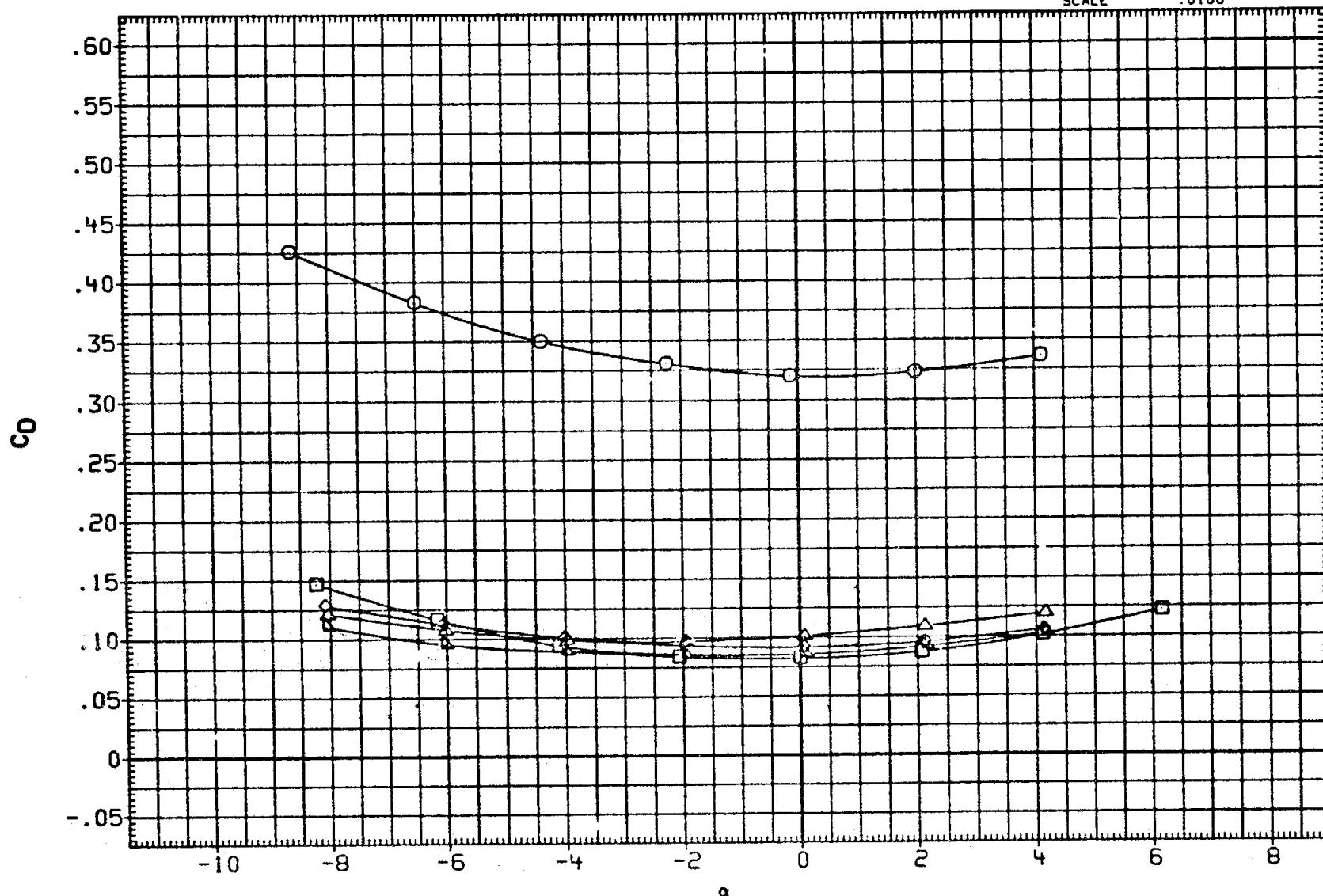


FIGURE 4. VEHICLE AERODYNAMIC CHARACTERISTICS, BETA=0 DEGREES

(A)MACH = .90

PAGE 2

DATA SET SYMBOL	CONFIGURATION	BETA	IB-ELV	OB-ELV	REFERENCE INFORMATION
RKH001	○ LARC BFT TPT 787(LAI13) INTEGRATED VEH..1 STING	.000	10.000	4.000	SREF 2690.0000 SQ.FT.
RKH004	□ LARC BFT TPT 787(LAI13) ORBITER ALONE	.000	10.000	4.000	LREF 1290.3000 INCHES
RKH007	△ LARC BFT TPT 787(AI13) ORB.NEAR TANK,NO HOHARE	.000	10.000	4.000	BREF 1290.3000 INCHES
RKH010	△ LARC BFT TPT 787(LAI13) ORB.NEAR TANK,HOHR ON OB	.000	10.000	4.000	XMRP 976.0000 IN. XT
RKH013	□ LARC BFT TPT 787(LAI13) ORB.NEAR TANK,HOHR ON TK	.000	10.000	4.000	YMRP .0000 IN. YT
				ZMRP 400.0000 IN. ZT	
				SCALE .0100	

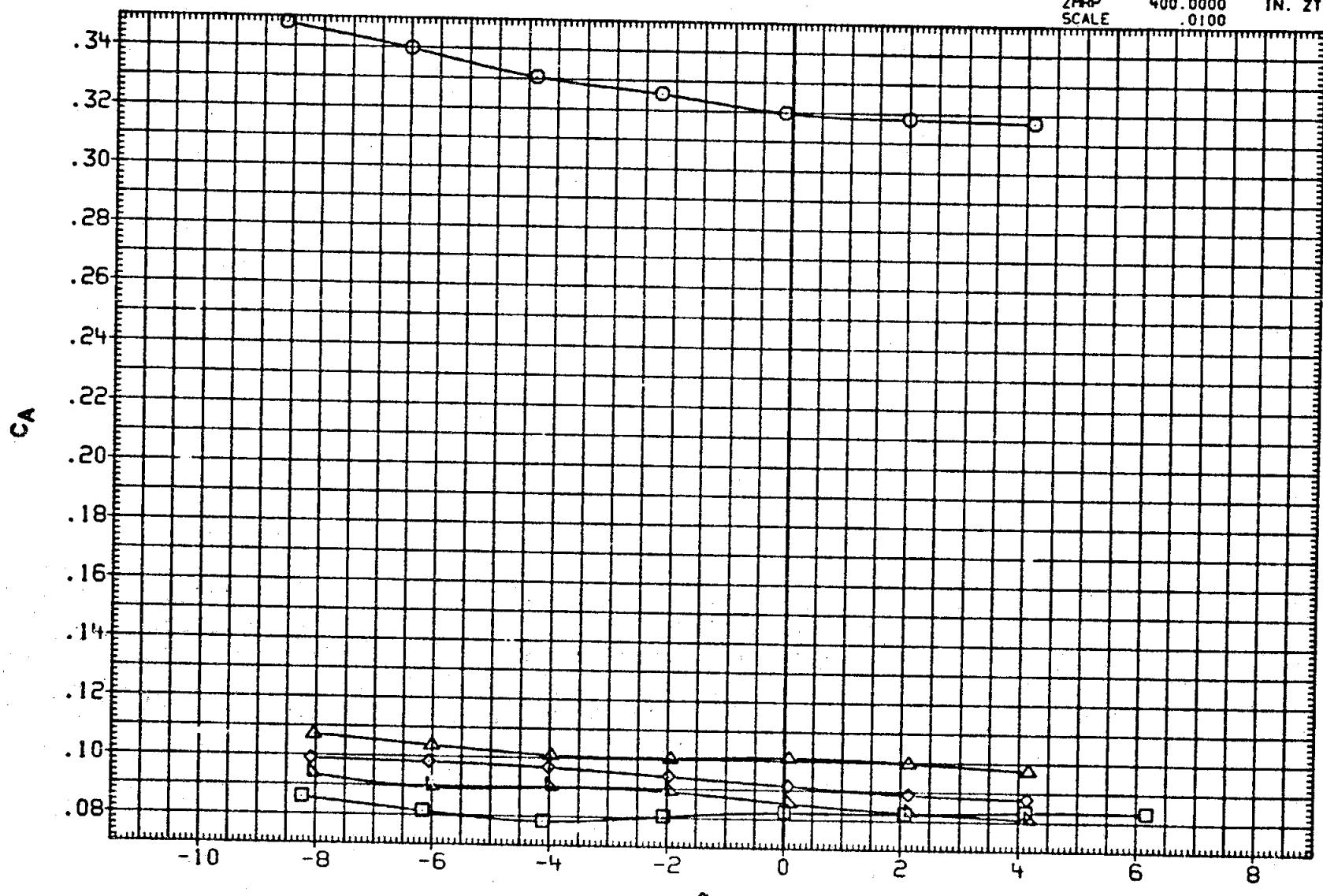


FIGURE 4. VEHICLE AERODYNAMIC CHARACTERISTICS, BETA=0 DEGREES

(A)MACH = .90

DATA SET SYMBOL

CONFIGURATION

RKH001	○	LARC BFT TPT 787(LA113) INTEGRATED VEH.,1 STING
RKH004	□	LARC BFT TPT 787(LA113) ORBITER ALONE
RKH007	◇	LARC BFT TPT 787(LA113) ORB.NEAR TANK,NO HODARE
RKH010	△	LARC BFT TPT 787(LA113) ORB.NEAR TANK,HODR ON OB
RKH013	▽	LARC BFT TPT 787(LA113) ORB.NEAR TANK,HODR ON TK

BETA 18-ELV 08-ELV

.000	10.000	4.000
.000	10.000	4.000
.000	10.000	4.000
.000	10.000	4.000
.000	10.000	4.000

REFERENCE INFORMATION

SREF	2690.0000	SO.FT.
LREF	1290.3000	INCHES
BREF	1290.3000	INCHES
XMRP	976.0000	IN. XT
YMRP	.0000	IN. YT
ZMRP	400.0000	IN. ZT
SCALE	.0100	

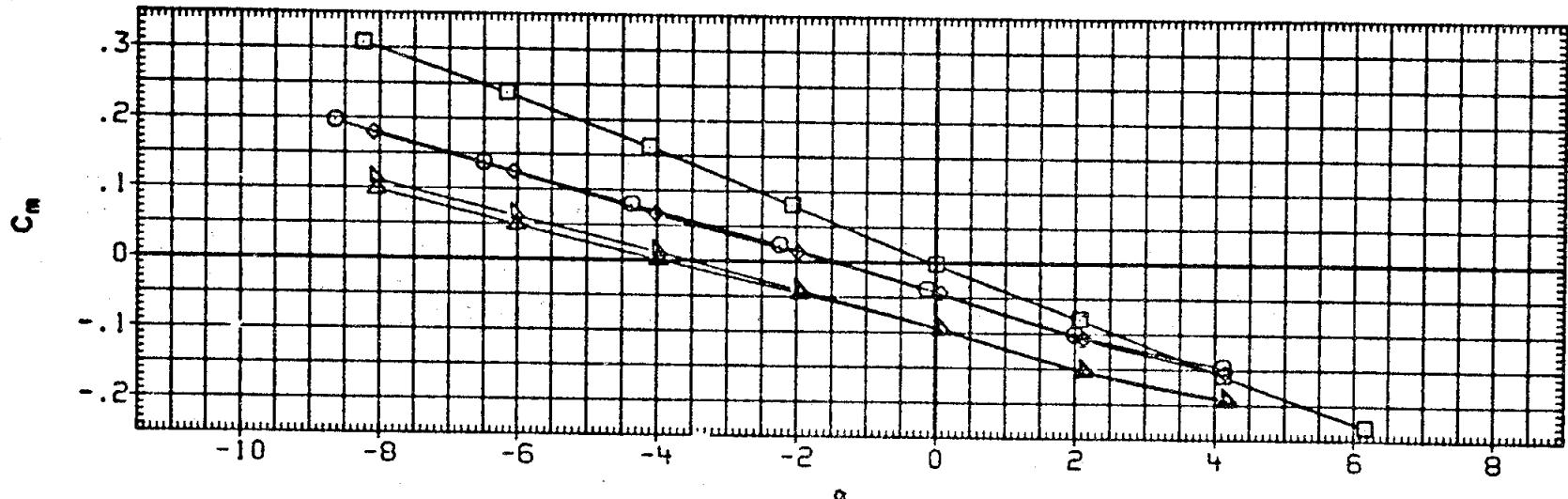
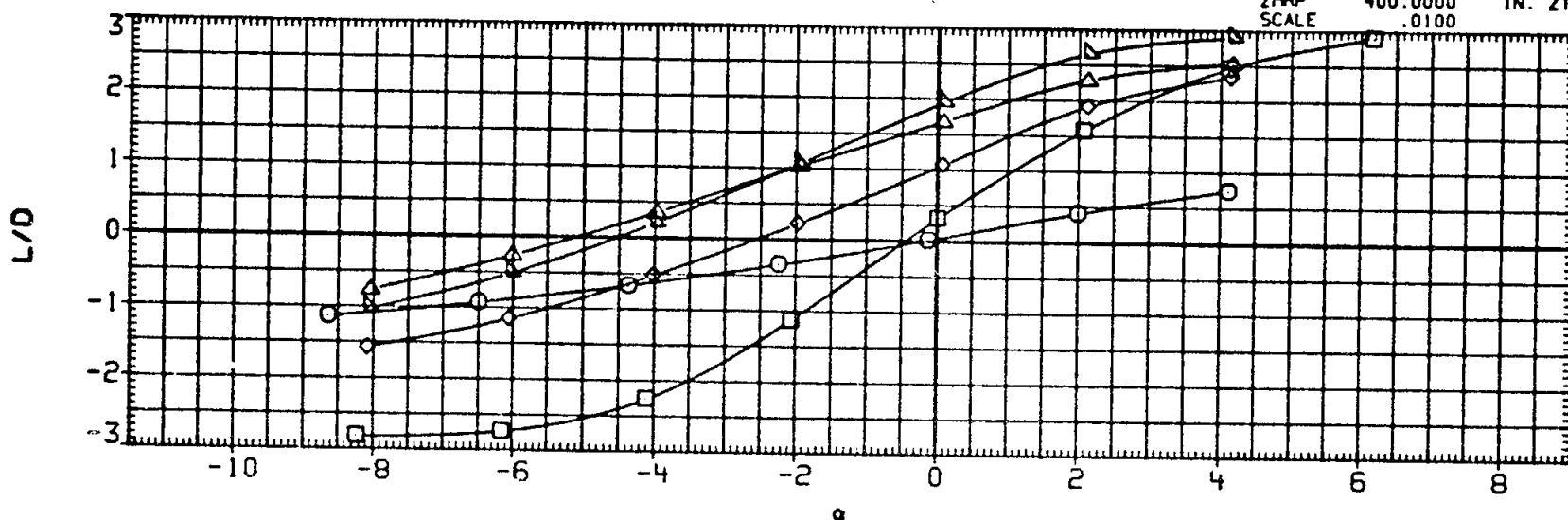


FIGURE 4. VEHICLE AERODYNAMIC CHARACTERISTICS, BETA=0 DEGREES

(A)MACH = .90

PAGE 4

DATA SET SYMBOL

CONFIGURATION

	BETA	IB-ELV	OB-ELV
RKH001	.000	10.000	4.000
RKH004	.000	10.000	4.000
RKH007	.000	10.000	4.000
RKH010	.000	10.000	4.000
RKH013	.000	10.000	4.000

	REFERENCE INFORMATION
SREF	2690.0000 SQ.FT.
LREF	1290.3000 INCHES
BREF	1290.3000 INCHES
XMRP	976.0000 IN. XT
YMRP	.0000 IN. YT
ZMRP	400.0000 IN. ZT
SCALE	.0100

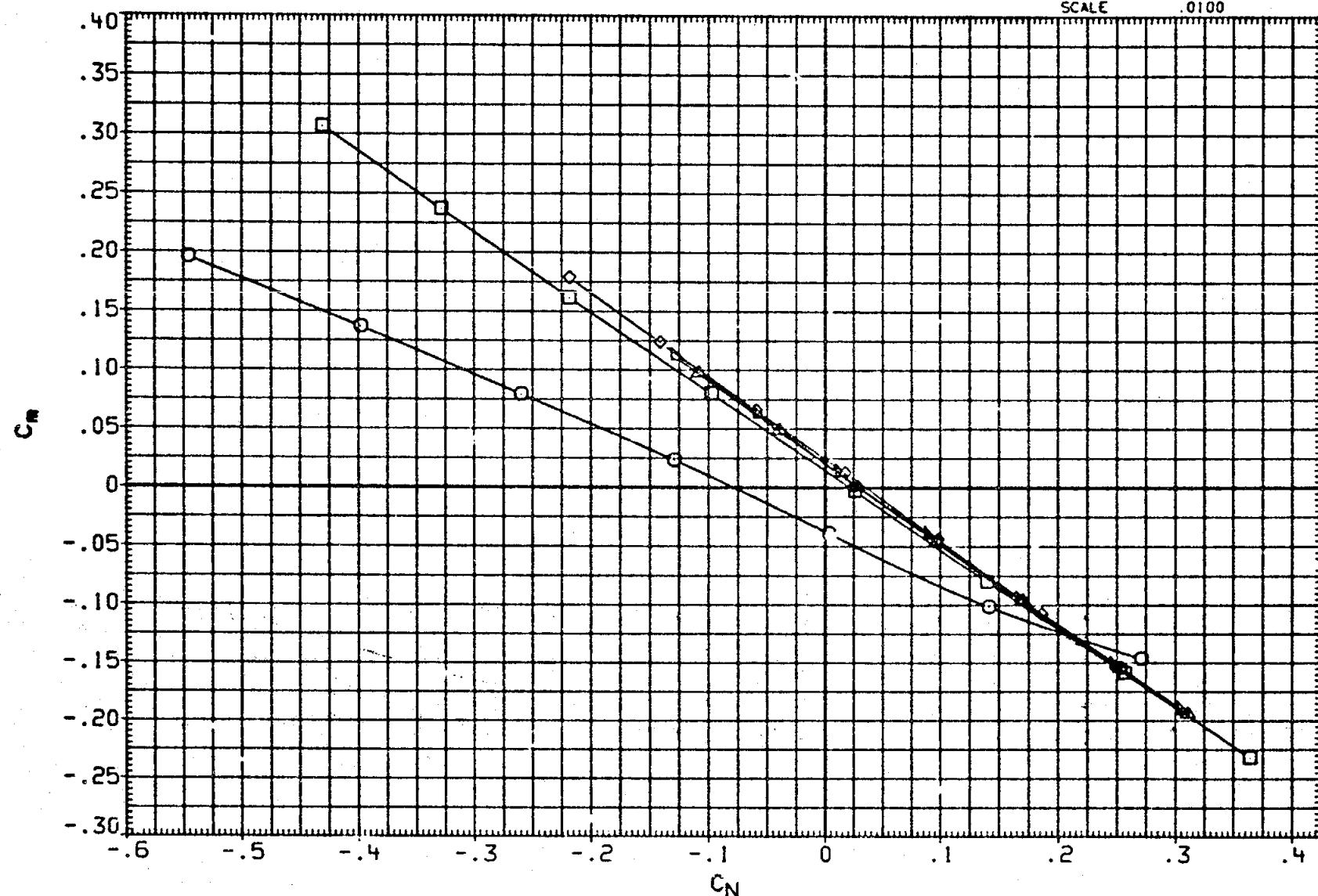


FIGURE 4. VEHICLE AERODYNAMIC CHARACTERISTICS, BETA=0 DEGREES

DATA SET SYMBOL		CONFIGURATION	BETA	1B-ELV	0B-ELV	REFERENCE INFORMATION		
RKH001	○	LARC BFT TPT 787(LA113) INTEGRATED VEH.,I STING	.000	10.000	4.000	SREF	2690.0000	SO.FT.
RKH004	□	LARC BFT TPT 787(LA113) ORBITER ALONE	.000	10.000	4.000	LREF	1290.3000	INCHES
RKH007	◇	LARC BFT TPT 787(LA113) ORB.NEAR TANK,NO HDWRE	.000	10.000	4.000	BREF	1290.3000	INCHES
RKH010	△	LARC BFT TPT 787(LA113) ORB.NEAR TANK,HDWR ON OB	.000	10.000	4.000	XMRP	976.0000	IN. XT
RKH013	▽	LARC BFT TPT 787(LA113) ORB.NEAR TANK,HDWR ON TK	.000	10.000	4.000	YMRP	.0000	IN. YT
						ZMRP	400.0000	IN. ZT
						SCALE	.0100	

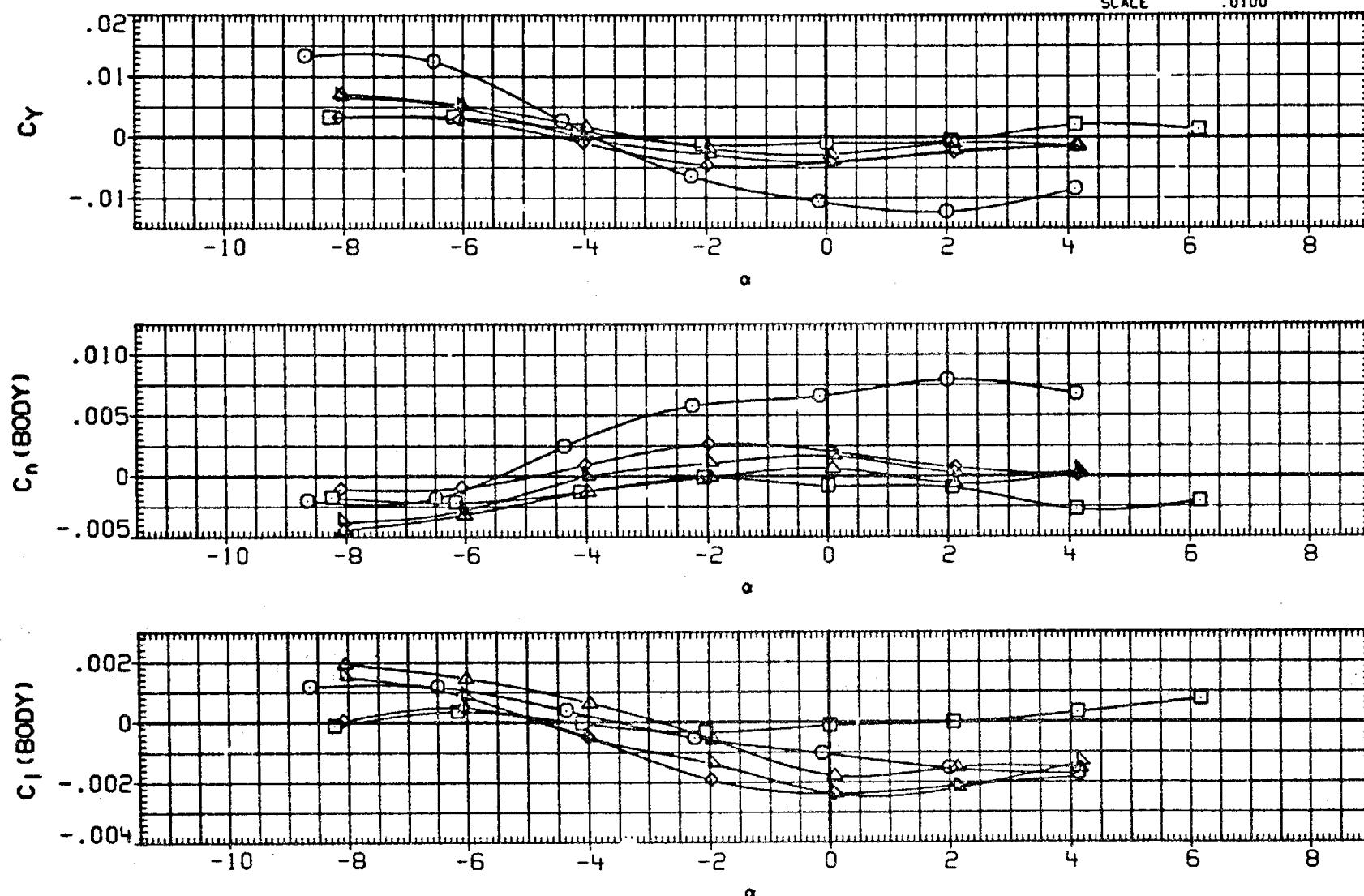


FIGURE 4. VEHICLE AERODYNAMIC CHARACTERISTICS, BETA=0 DEGREES

(A)MACH = .90

PAGE

6

DATA SET SYMBOL	CONFIGURATION	BETA	IB-ELV	OB-ELV	REFERENCE INFORMATION
RKH003 O	LARC BFT TPT 787(LAII13) INTEGRATED VEH., I STING	-6.000	10.000	4.000	SREF 2690.0000 SQ.FT.
RKH006 □	LARC BFT TPT 787(LAII13) ORBITER ALONE	-6.000	10.000	4.000	LREF 1290.3000 INCHES
RKH009 ◇	LARC BFT TPT 787(LAII13) ORB.NEAR TANK, NO HOWARE	-6.000	10.000	4.000	BREF 1290.3000 INCHES
RKH012 △	LARC BFT TPT 787(LAII13) ORB.NEAR TANK, HOWR ON OB	-6.000	10.000	4.000	XMRP 976.0000 IN. XT
RKH015 ▽	LARC BFT TPT 787(LAII13) ORB.NEAP TANK, HOWR ON TK	-6.000	10.000	4.000	YMRP .0000 IN. YT
				ZMRP 400.0000 IN. ZT	
				SCALE .0100	

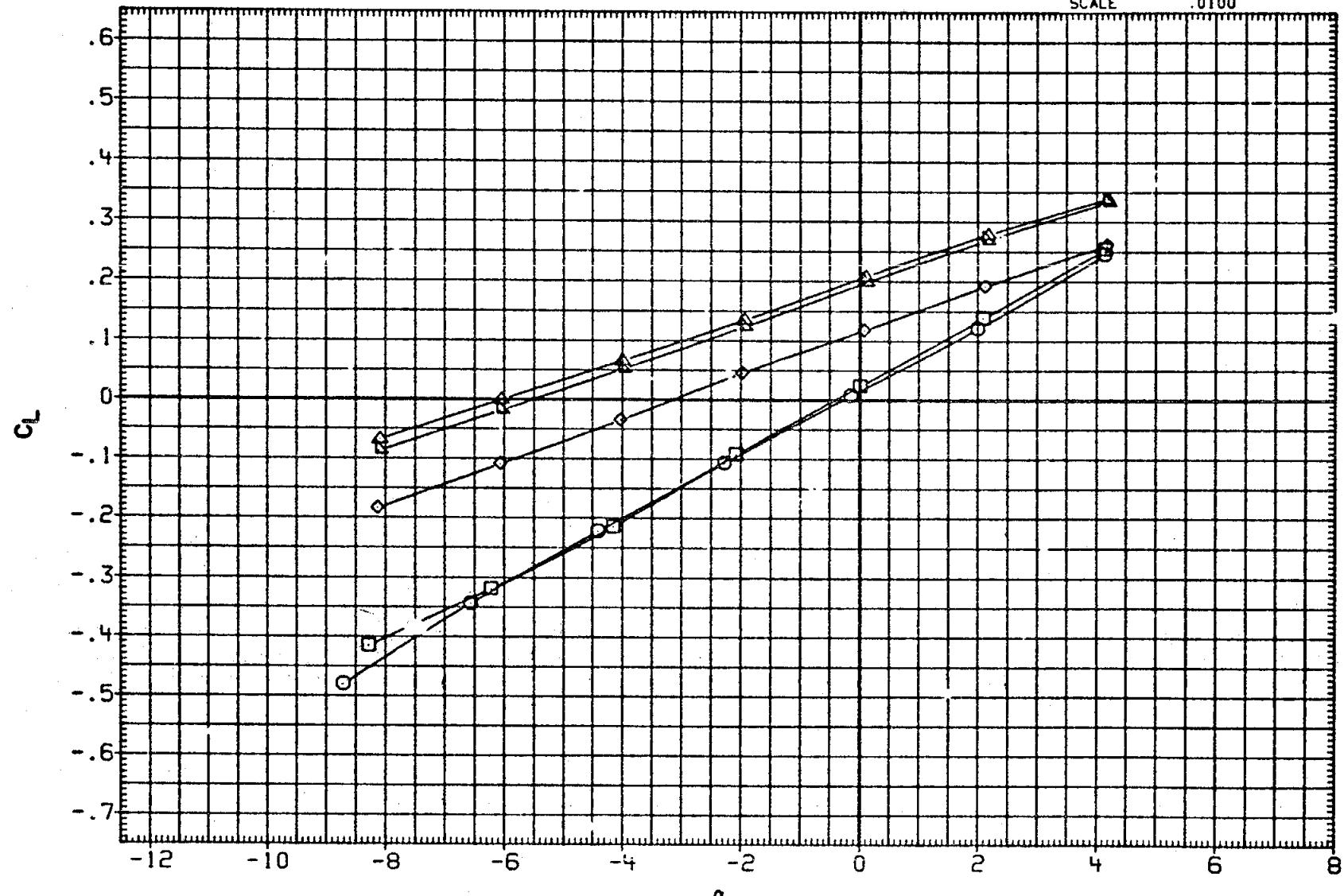


FIGURE 5. VEHICLE AERODYNAMIC CHARACTERISTICS, BETA=-6 DEGREES

(A)MACH = .90

DATA SET SYMBOL	CONFIGURATION	BETA	1B-ELV	0B-ELV	REFERENCE INFORMATION
RKH003	○ LARC BFT TPT 787(LA113) INTEGRATED VEH..I STING	-6.000	10.000	4.000	SREF 2690.0000 SQ.FT.
RKH006	□ LARC BFT TPT 787(LA113) ORBITER ALONE	-6.000	10.000	4.000	LREF 1290.3000 INCHES
RKH009	◊ LARC BFT TPT 787(LA113) ORB.NEAR TANK,NO HDWRE	-6.000	10.000	4.000	BREF 1290.3000 INCHES
RKH012	△ LARC BFT TPT 787(LA113) ORB.NEAR TANK,HDWR ON OB	-6.000	10.000	4.000	XMRP 976.0000 IN. XT
RKH015	▷ LARC BFT TPT 787(LA113) ORB.NEAR TANK,HDWR ON TK	-6.000	10.000	4.000	YMRP .0000 IN. YT
				ZMRP 400.0000 IN. ZT	
				SCALE .0100	

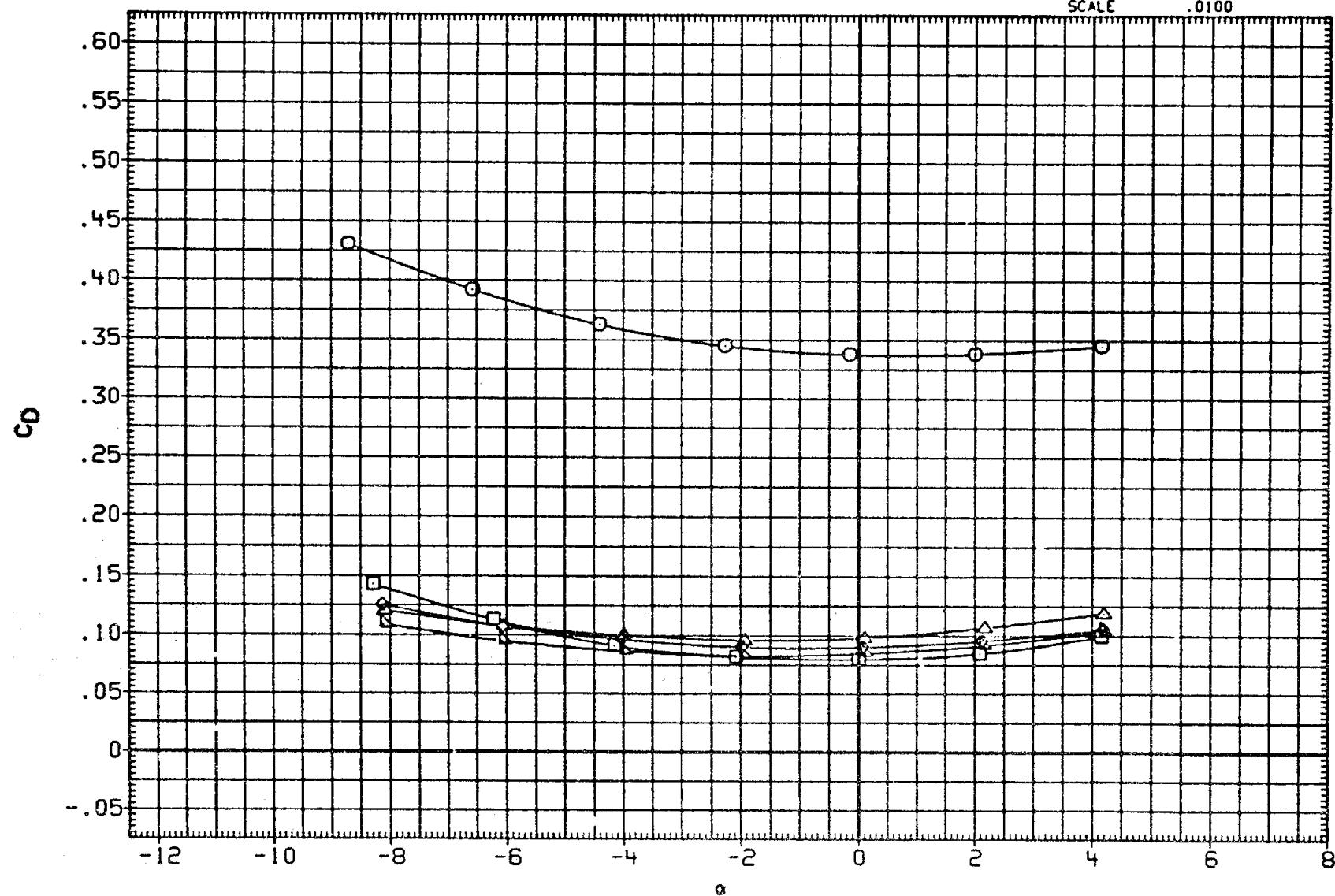


FIGURE 5. VEHICLE AERODYNAMIC CHARACTERISTICS, BETA=-6 DEGREES

(A)MACH = .90

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DATA SET SYMBOL		CONFIGURATION	BETA	IB-ELV	OB-ELV	REFERENCE INFORMATION		
RKH003	○	LARC BFT TPT 787(LA113) INTEGRATED VEH.,I STING	-6.000	10.000	4.000	SREF	2690.0000	50.FT.
RKH006	□	LARC BFT TPT 787(LA113) ORBITER ALONE	-6.000	10.000	4.000	LREF	1290.3000	INCHES
RKH009	◇	LARC BFT TPT 787(LA113) ORB.NEAR TANK,NO HW/ARE	-6.000	10.000	4.000	BREF	1290.3000	INCHES
RKH012	△	LARC BFT TPT 787(LA113) ORB.NEAR TANK,HWR ON OB	-6.000	10.000	4.000	XMRP	976.0000	IN. XT
RKH015	▷	LARC BFT TPT 787(LA113) ORB.NEAR TANK,HWR ON TK	-6.000	10.000	4.000	YMRP	.0000	IN. YT
						ZMRP	400.0000	IN. ZT
						SCALE	.0100	

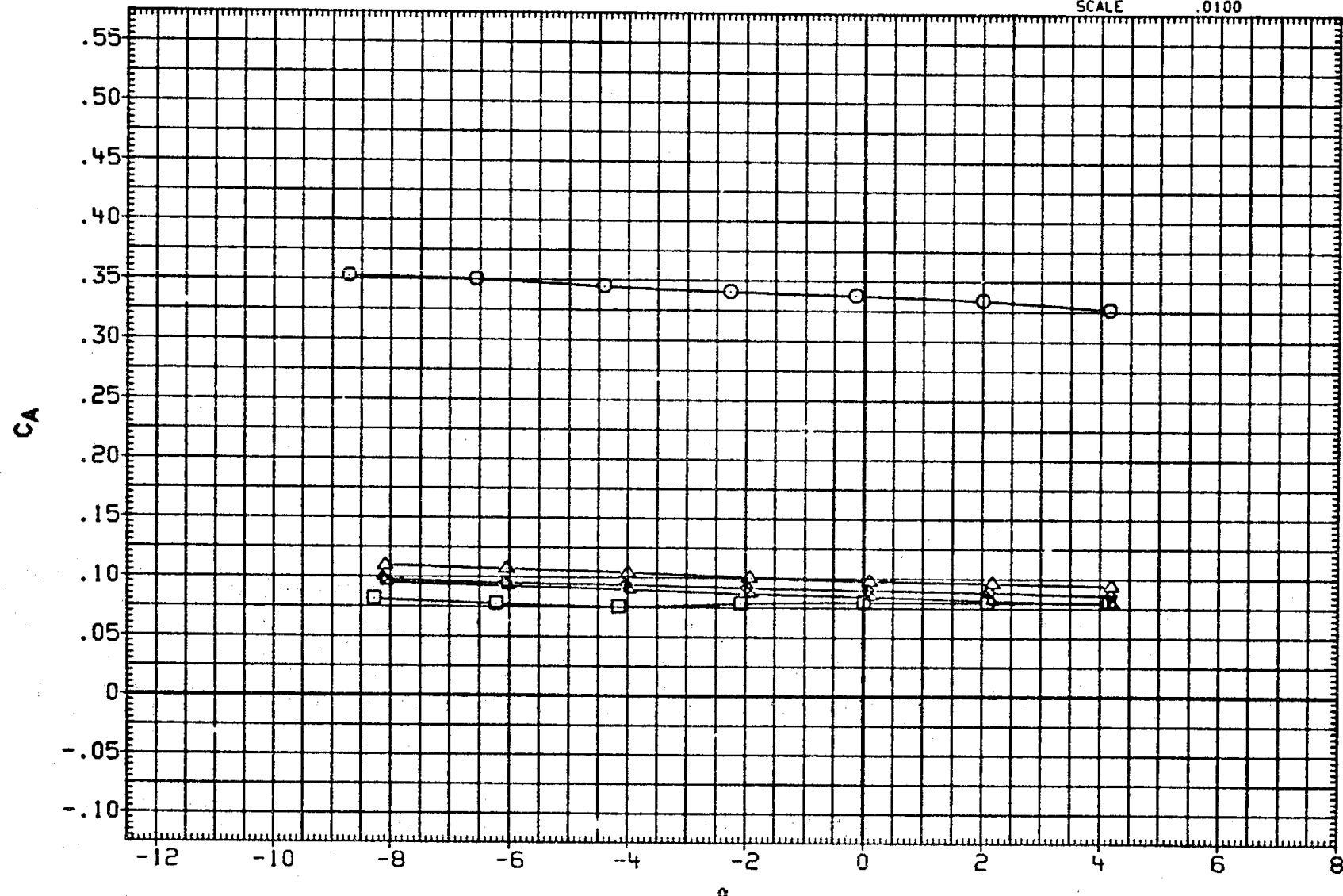


FIGURE 5. VEHICLE AERODYNAMIC CHARACTERISTICS, BETA=-6 DEGREES

(A) MACH = .90

DATA SET SYMBOL	CONFIGURATION	BETA	IB-ELV	OB-ELV	REFERENCE INFORMATION
RKH03	C LARC BFT TPT 787(LA113) INTEGRATED VEH..I STING	-6.000	10.000	4.000	SREF 2690.0000 SO.FT.
RKH06	□ LARC BFT TPT 787(LA113) ORBITER ALONE	-6.000	10.000	4.000	LREF 1290.3000 INCHES
RKH09	◊ LARC BFT TPT 787(LA113) ORB.NEAR TANK.NO HOWRE	-6.000	10.000	4.000	BREF 1290.3000 INCHES
RKH12	△ LARC BFT TPT 787(LA113) ORB.NEAR TANK.HOWR ON OB	-6.000	10.000	4.000	XMRP 976.0000 IN. XT
RKH15	▽ LARC BFT TPT 787(LA113) ORB.NEAR TANK.HOWR ON TK	-6.000	10.000	4.000	YMRP .0000 IN. YT
				ZMRP 400.0000 IN. ZT	
				SCALE .0100	

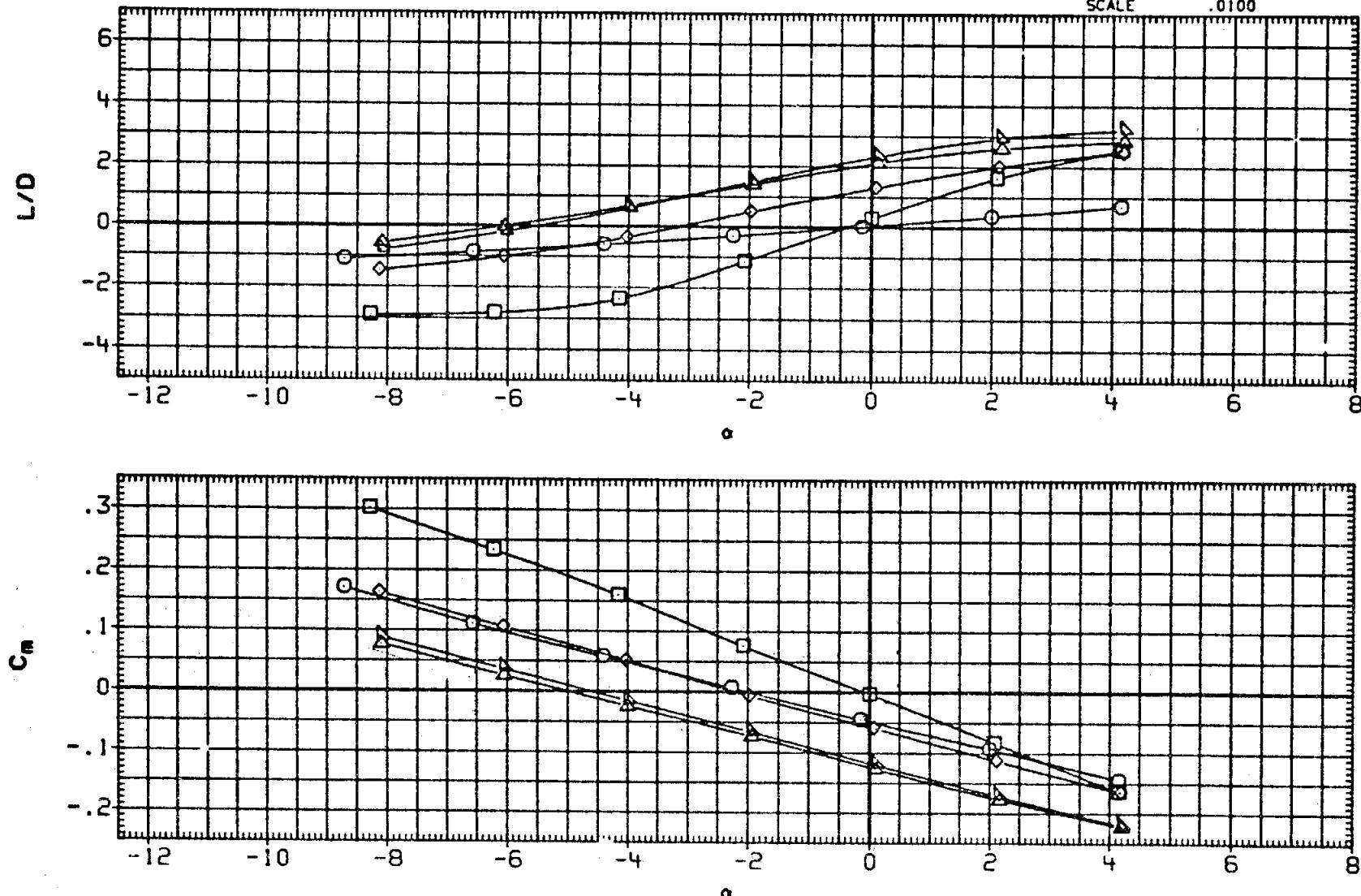


FIGURE 5. VEHICLE AERODYNAMIC CHARACTERISTICS, BETA=-6 DEGREES

(A)MACH = .90

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DATA SET SYMBOL	CONFIGURATION	BETA	IB-ELV	OB-ELV	REFERENCE INFORMATION
RKH003	○ LARC BFT TPT 787(LA113) INTEGRATED VEH.,1 STING	-6.000	10.000	4.000	SREF 2690.0000 50.FT.
RKH006	□ LARC BFT TPT 787(LA113) ORBITER ALONE	-6.000	10.000	4.000	LREF 1290.3000 INCHES
RKH009	◊ LARC BFT TPT 787(LA113) ORB.NEAR TANK,NO HOWRE	-6.000	10.000	4.000	BREF 1290.3000 INCHES
RKH012	△ LARC BFT TPT 787(LA113) ORB.NEAR TANK,HOWR ON OB	-6.000	10.000	4.000	XMRP 976.0000 IN. XT
RKH015	▷ LARC BFT TPT 787(LA113) ORB.NEAR TANK,HOWR ON TK	-6.000	10.000	4.000	YMRP .0000 IN. YT
				ZMRP 400.0000 IN. ZT	
				SCALE .0100	

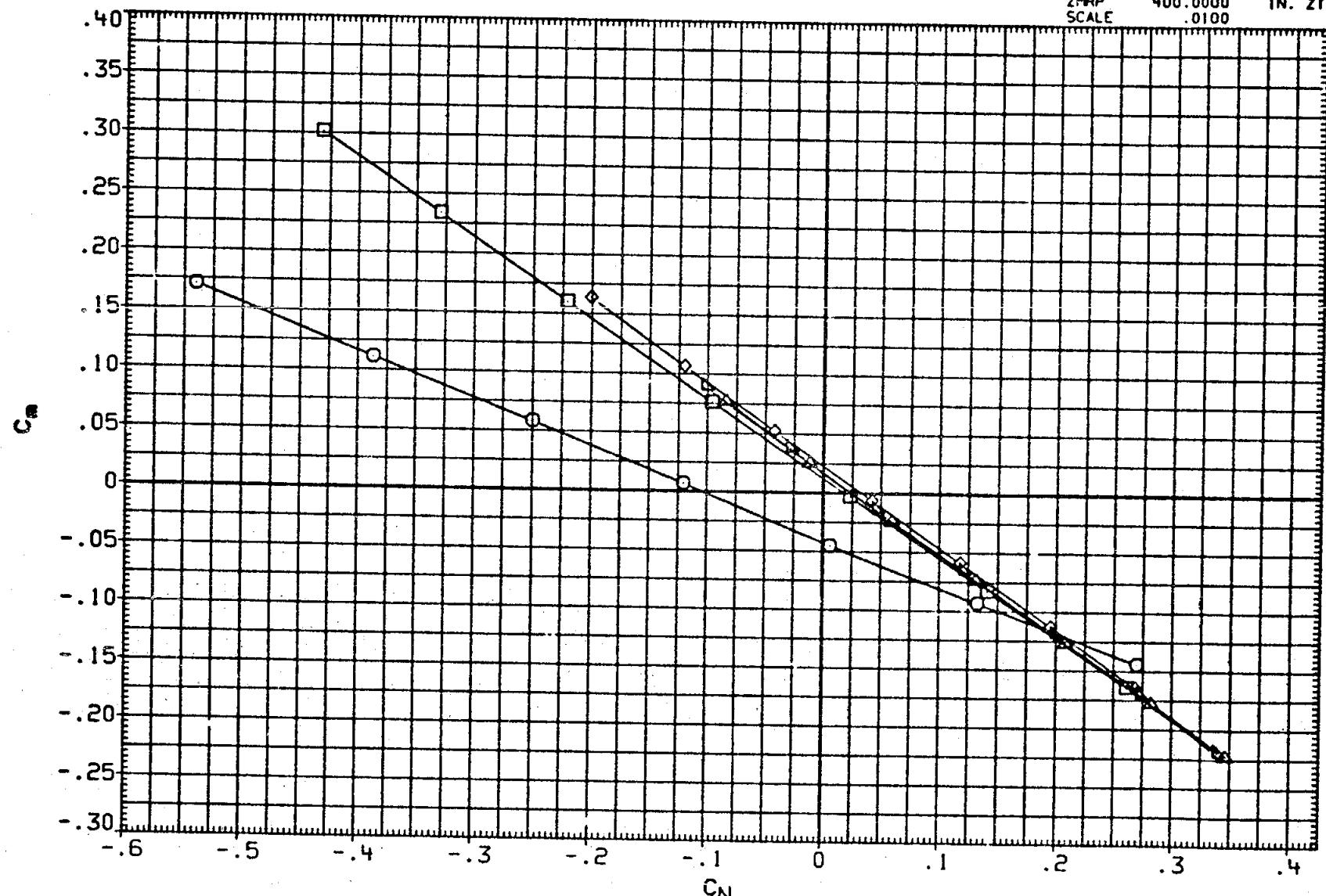


FIGURE 5. VEHICLE AERODYNAMIC CHARACTERISTICS, BETA=-6 DEGREES

(A)MACH = .90

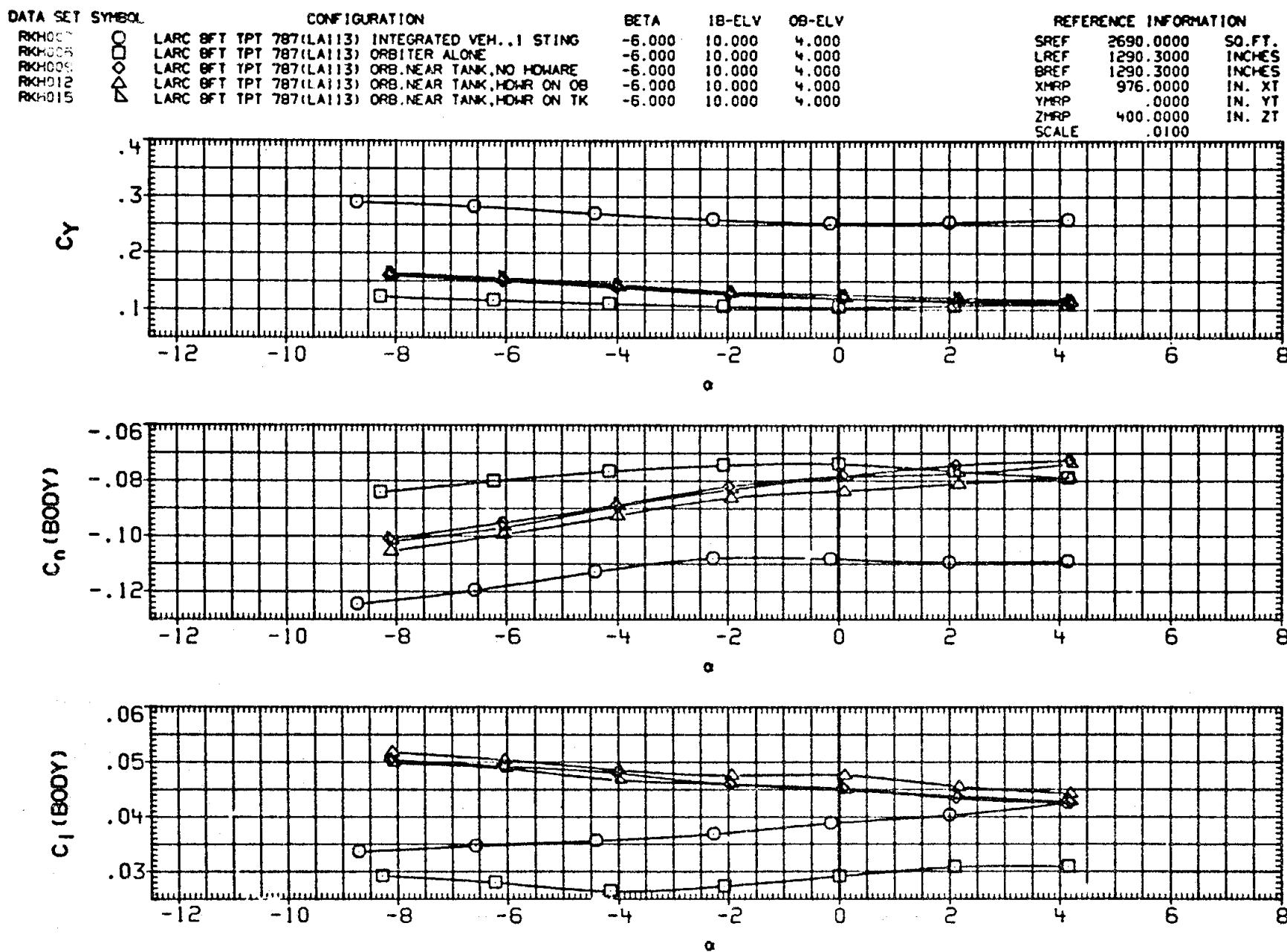


FIGURE 5. VEHICLE AERODYNAMIC CHARACTERISTICS, BE β A=-6 DEGREES

(A) MACH = .90

PAGE 12

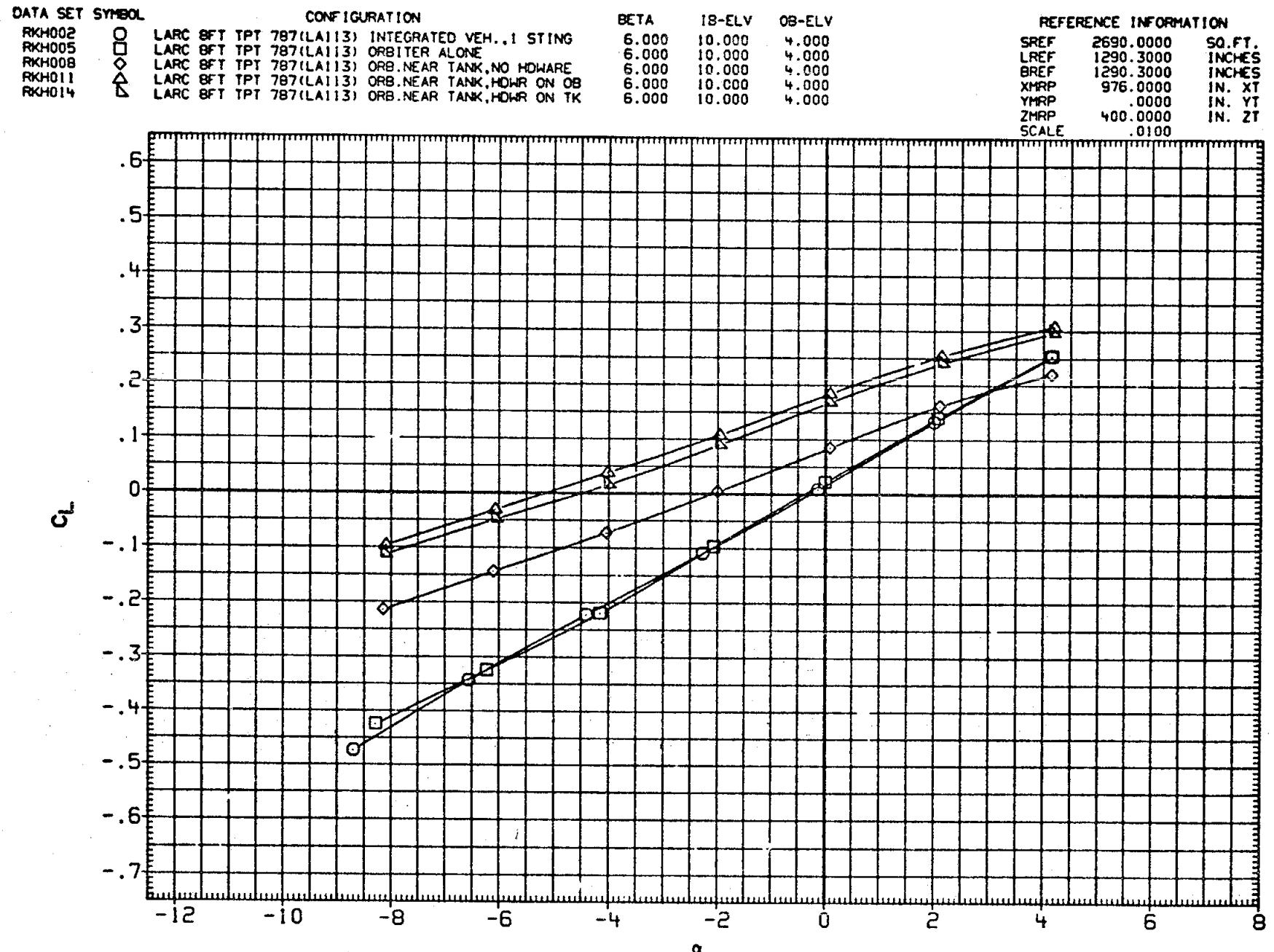


FIGURE 6. VEHICLE AERODYNAMIC CHARACTERISTICS, BETA= 6 DEGREES

(A)MACH = .90

DATA SET SYMBOL

		CONFIGURATION
RKH002	O	LARC BFT TPT 787(LA113) INTEGRATED VEH.,1 STING
RKH005	□	LARC BFT TPT 787(LA113) ORBITER ALONE
RKH008	◇	LARC BFT TPT 787(LA113) ORB.NEAR TANK,NO HWARE
RKH011	△	LARC BFT TPT 787(LA113) ORB.NEAR TANK,HWR ON OB
RKH014	▽	LARC BFT TPT 787(LA113) ORB.NEAR TANK,HWR ON TK

BETA	OB-ELV	OB-ELV
6.000	10.000	4.000
6.000	10.000	4.000
6.000	10.000	4.000
6.000	10.000	4.000
6.000	10.000	4.000

REFERENCE INFORMATION		
SREF	2690.0000	SO.FT.
LREF	1290.3000	INCHES
BREF	1290.3000	INCHES
XMRP	976.0000	IN. XT
YMRP	.0000	IN. YT
ZMRP	400.0000	IN. ZT
SCALE	.0100	

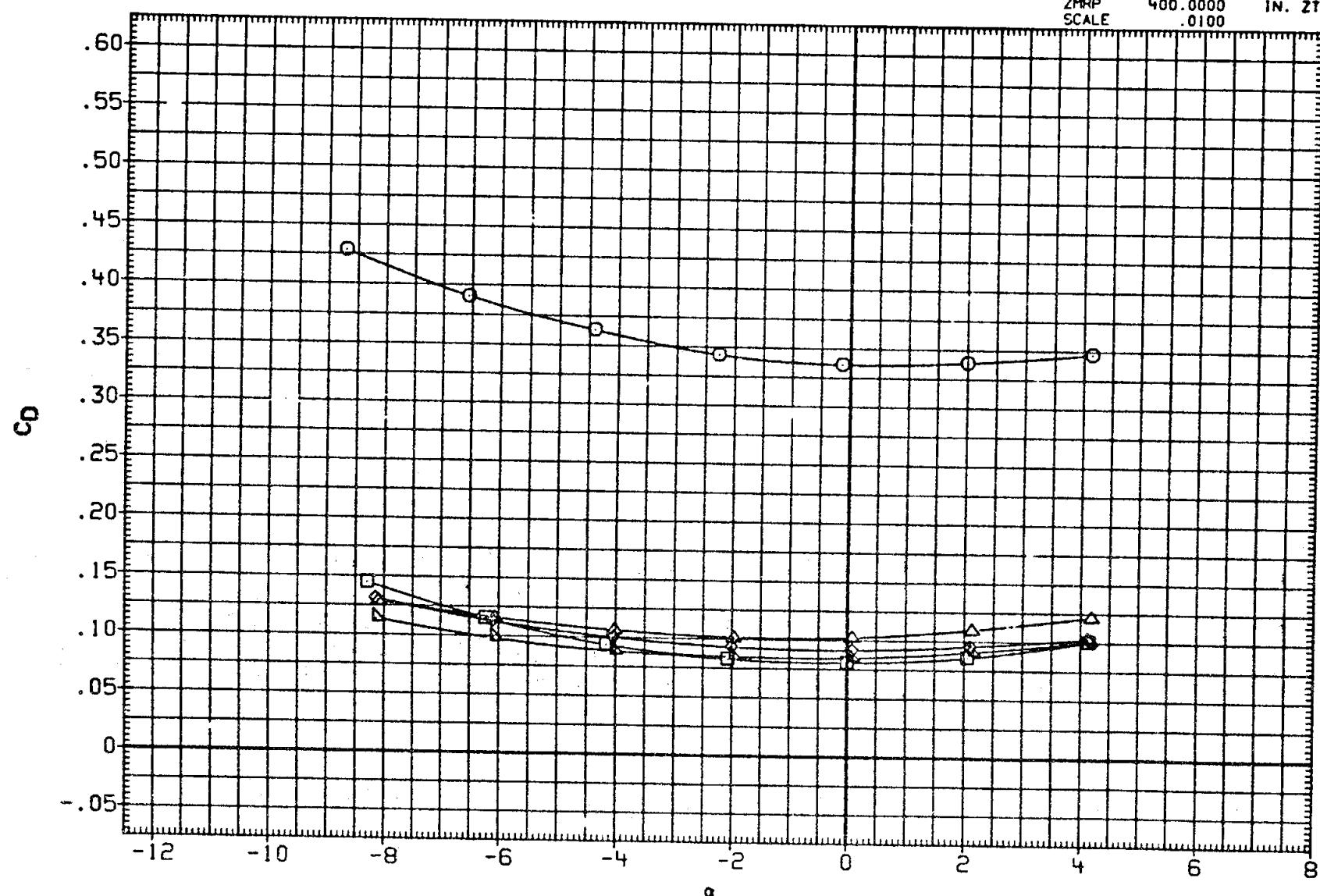


FIGURE 6. VEHICLE AERODYNAMIC CHARACTERISTICS, BETA= 6 DEGREES

(A)MACH = .90

DATA SET SYMBOL	CONFIGURATION	BETA	IB-ELV	OB-ELV	REFERENCE INFORMATION
RKH002	○ LARC 8FT TPT 787(LA113) INTEGRATED VEH.,1 STING	6.000	10.000	4.000	SREF 2690.0000 SO.FT.
RKH005	□ LARC 8FT TPT 787(LA113) ORBITER ALONE	6.000	10.000	4.000	LREF 1290.3000 INCHES
RKH008	◇ LARC 8FT TPT 787(LA113) ORB.NEAR TANK.NO HWAR	6.000	10.000	4.000	BREF 1290.3000 INCHES
RKH011	△ LARC 8FT TPT 787(LA113) ORB.NEAR TANK,HWR ON OB	6.000	10.000	4.000	XMRP 976.0000 IN. YT
RKH014	▽ LARC 8FT TPT 787(LA113) ORB.NEAR TANK,HWR ON TK	6.000	10.000	4.000	YMRP .0000 IN. YT
				ZMRP 400.0000 IN. ZT	
				SCALE .0100	

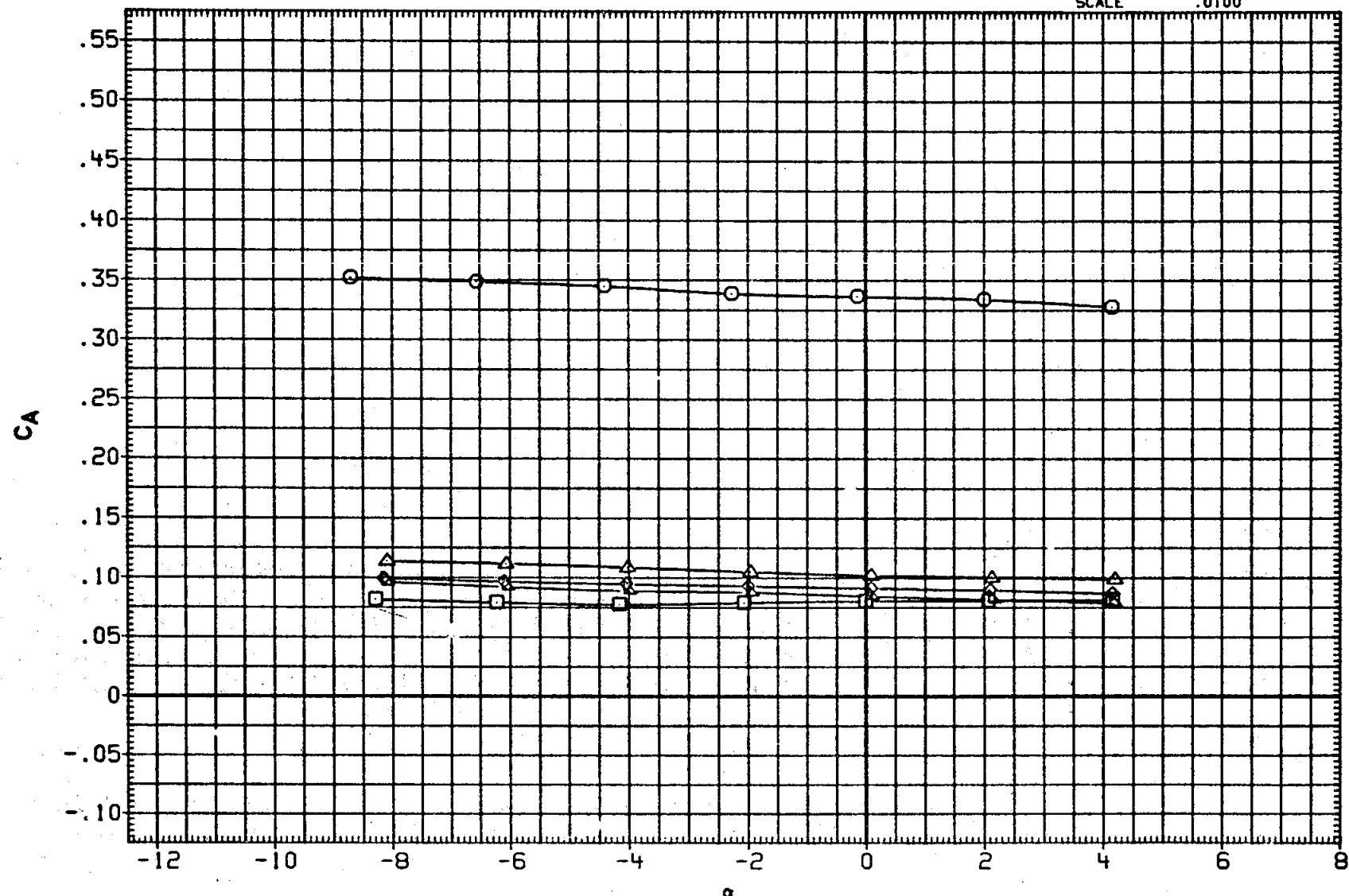


FIGURE 6. VEHICLE AERODYNAMIC CHARACTERISTICS, BETA= 6 DEGREES

DATA SET SYMBOL

	CONFIGURATION
RKH002	○ LARC BFT TPT 787(LA113) INTEGRATED VEH.,1 STING
RKH005	□ LARC BFT TPT 787(LA113) ORBITER ALONE
RKH008	◇ LARC BFT TPT 787(LA113) ORB.NEAR TANK,NO HW/ARE
RKH011	△ LARC BFT TPT 787(LA113) ORB.NEAR TANK,HWR ON OB
RKH014	▽ LARC BFT TPT 787(LA113) ORB.NEAR TANK,HWR ON TK

BETA	IB-ELV	OB-ELV
6.000	10.000	4.000
6.000	10.000	4.000
6.000	10.000	4.000
6.000	10.000	4.000
6.000	10.000	4.000

REFERENCE INFORMATION

SREF	2690.0000	SQ.FT.
LREF	1290.3000	INCHES
BREF	1290.3000	INCHES
XMRP	976.0000	IN. XT
YMRP	.0000	IN. YT
ZMRP	400.0000	IN. ZT
SCALE	.0100	

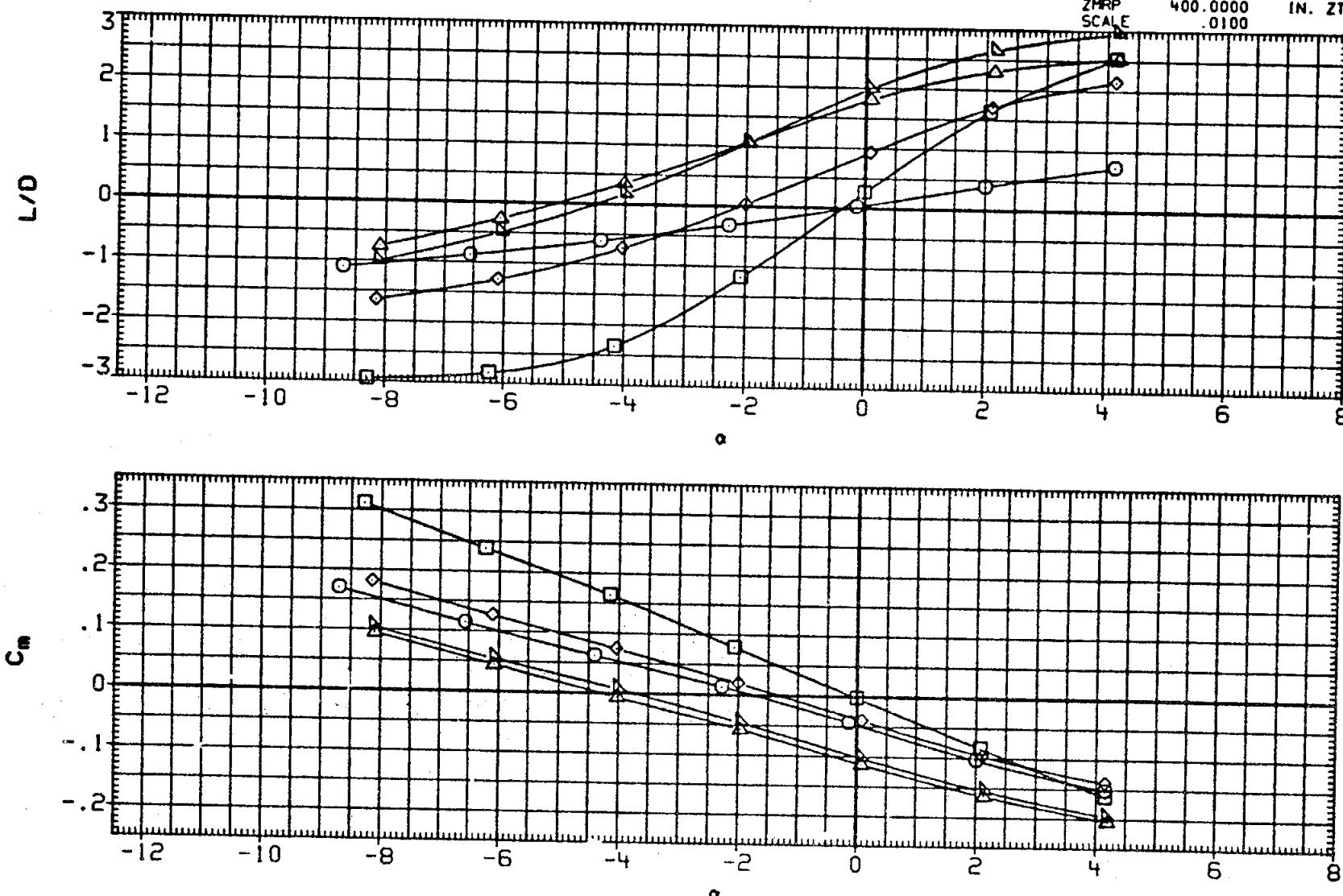


FIGURE 6. VEHICLE AERODYNAMIC CHARACTERISTICS, BETA= 6 DEGREES

(A)MACH = .90

DATA SET SYMBOL

	CONFIGURATION
RKH002	LARC BFT TPT 787(LA113) INTEGRATED VEH.,1 STING
RKH005	LARC BFT TPT 787(LA113) ORBITER ALONE
RKH008	LARC BFT TPT 787(LA113) ORB.NEAR TANK,NO HDWRE
RKH011	LARC BFT TPT 787(LA113) ORB.NEAR TANK,HDWR ON OB
RKH014	LARC BFT TPT 787(LA113) ORB.NEAR TANK,HDWR ON TK

BETA	IB-ELV	OB-ELV
6.000	10.000	4.000
6.000	10.000	4.000
6.000	10.000	4.000
6.000	10.000	4.000
6.000	10.000	4.000

REFERENCE INFORMATION		
SREF	2690.0000	SQ.FT.
LREF	1290.3000	INCHES
BREF	1290.3000	INCHES
XMRP	976.0000	IN. XT
YMRP	.0000	IN. YT
ZMRP	400.0000	IN. ZT
SCALE	.0100	

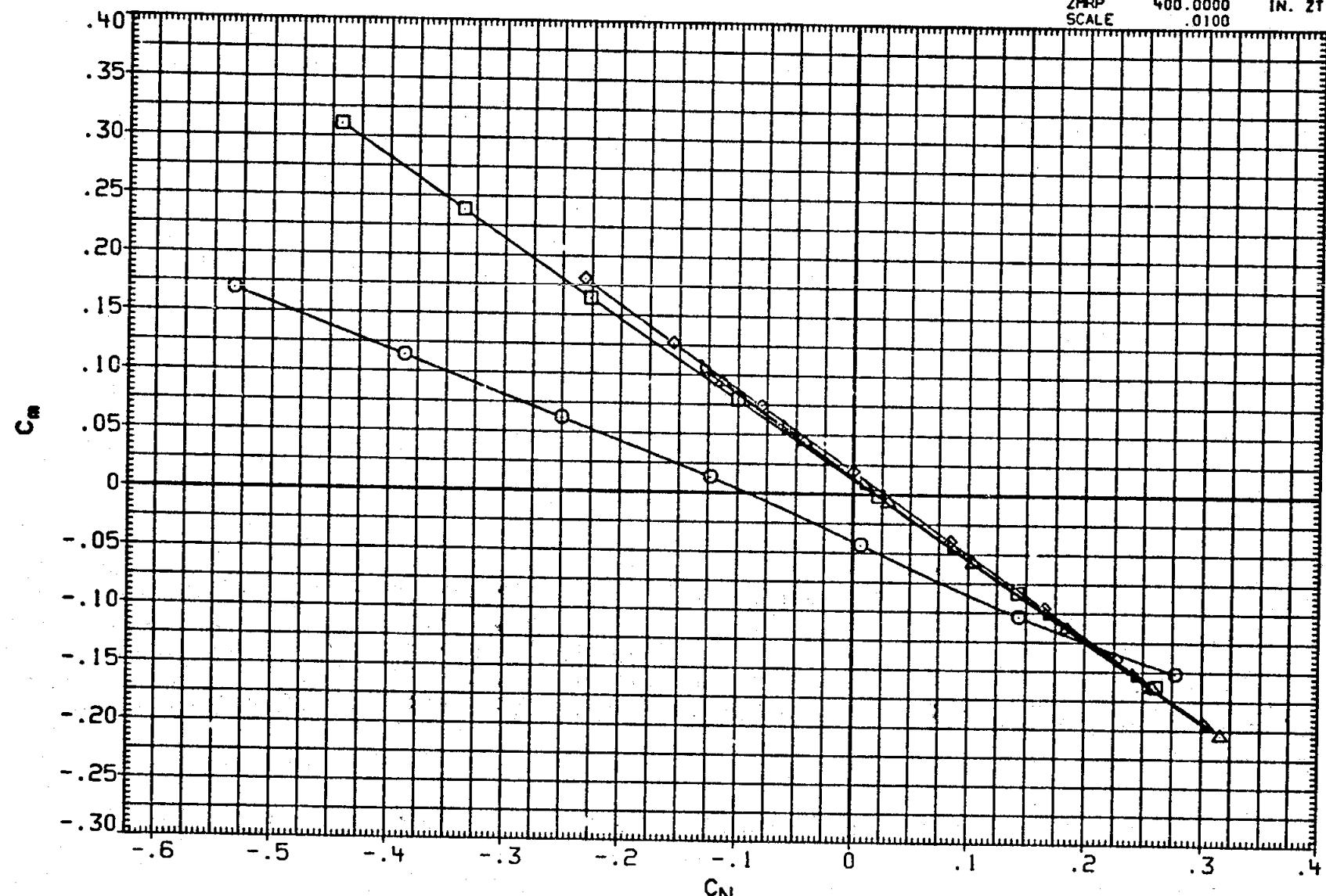


FIGURE 6. VEHICLE AERODYNAMIC CHARACTERISTICS, BETA= 6 DEGREES

(A)MACH = .90

DATA SET SYMBOL	CONFIGURATION	BETA	1B-ELV	OB-ELV	REFERENCE INFORMATION
RKH013	○ LARC 8FT TPT 787(LA113) INTEGRATED VEH.,1 STING	6.000	10.000	4.000	SREF 2690.0000 SQ.FT.
RKH015	□ LARC 8FT TPT 787(LA113) ORBITER ALONE	6.000	10.000	4.000	LREF 1290.3000 INCHES
RKH008	◊ LARC 8FT TPT 787(LA113) ORB.NEAR TANK,NO HDWRE	6.000	10.000	4.000	BREF 1290.3000 INCHES
RKH011	△ LARC 8FT TPT 787(LA113) ORB.NEAR TANK,HDWR ON OB	6.000	10.000	4.000	XMRP 976.0000 IN. XT
RKH014	▷ LARC 8FT TPT 787(LA113) ORB.NEAR TANK,HDWR ON TK	6.000	10.000	4.000	YMRP .0000 IN. YT
				ZMRP 400.0000 IN. ZT	
				SCALE .0100	

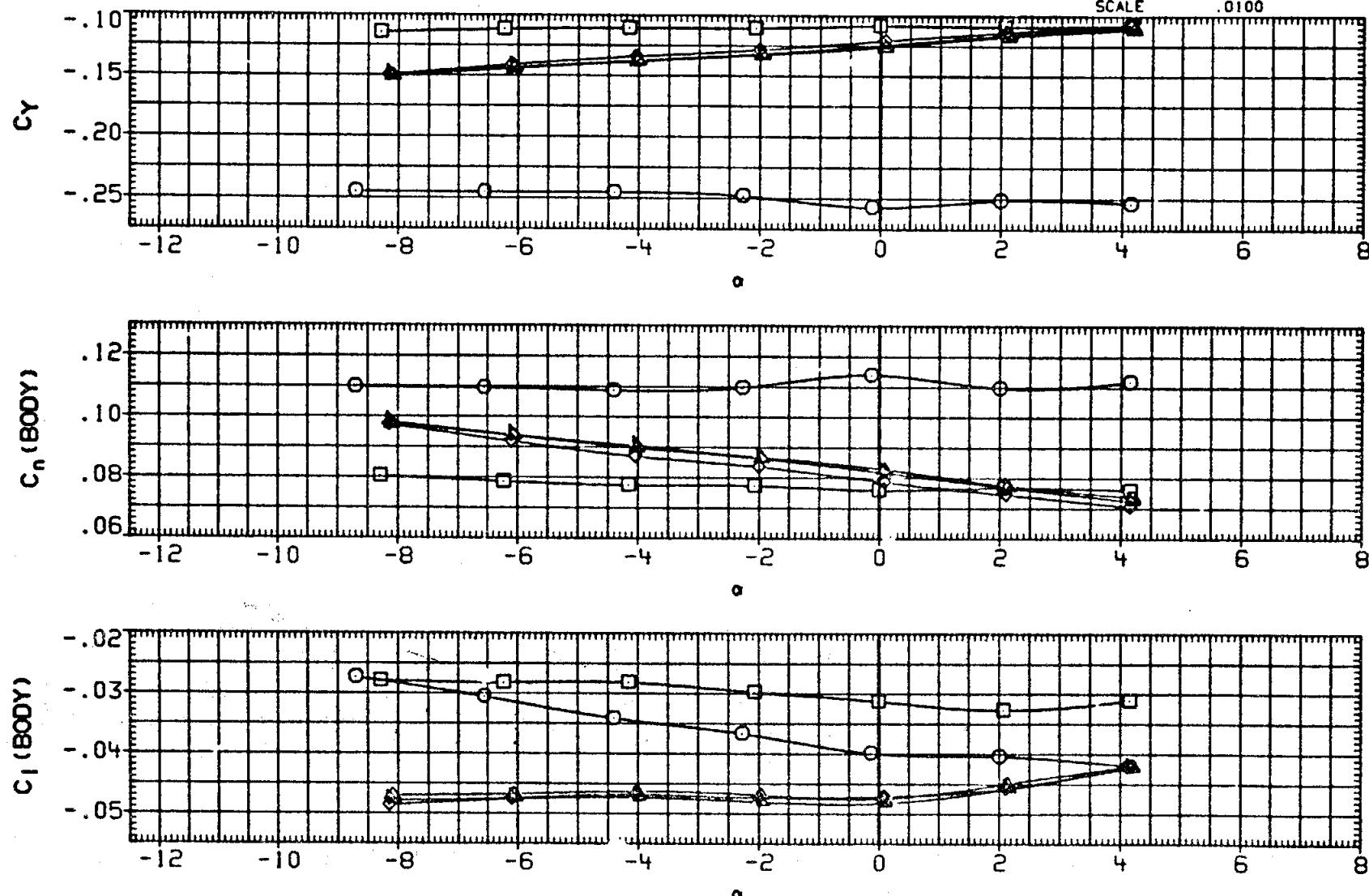


FIGURE 6. VEHICLE AERODYNAMIC CHARACTERISTICS, BETA= 6 DEGREES

(A)MACH = .90

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APPENDIX
TABULATED SOURCE DATA

<u>Dataset 1st Character</u>	<u>Pages</u>
R	1 - 8
S	8 - 15

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LARC 8FT TPT 787(LA113) INTEGRATED VEH.,1 STING

(RKH001) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = .000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 1/0 RN/L = 3.98 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	BETA	CN	CA	CLM	CBL	CYN	CY	CL	CD	L/D
.901	-8.644	-.01644	-.54603	.34759	.19565	.00116	-.00201	.01330	-.48759	.42570	-1.14538
.900	-6.500	-.01839	-.39787	.33952	.13655	.00116	-.00182	.01239	-.35688	.38238	-.93330
.900	-4.369	-.00986	-.25984	.33045	.07914	.00038	.00245	.00265	-.23391	.34929	-.66969
.900	-2.247	.00620	-.12888	.32545	.02311	-.00053	.00575	-.00644	-.11602	.33026	-.35130
.899	-.131	.02144	.00310	.31958	-.03919	-.00104	.00657	-.01063	.00383	.31957	.01200
.900	1.992	.01997	.14169	.31803	-.10161	-.00154	.00792	-.01230	.13055	.32277	.40447
.900	4.113	.01289	.27099	.31709	-.14665	-.00172	.00675	-.00854	.24754	.33571	.73738
GRADIENT		.00279	.06283	-.00161	-.02718	-.00025	.00051	-.00133	.05704	-.00163	.16837

LARC 8FT TPT 787(LA113) INTEGRATED VEH.,1 STING

(RKH002) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 975.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = 6.000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 2/0 RN/L = 3.98 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	BETA	CN	CA	CLM	CBL	CYN	CY	CL	CD	L/D
.900	-8.709	6.14575	-.53332	.35151	.16899	-.02735	.10978	-.24527	-.47395	.42821	-1.10680
.899	-6.561	6.17702	-.38647	.34820	.11379	-.03060	.10950	-.24548	-.34415	.39008	-.88225
.900	-4.406	6.20170	-.25023	.34471	.06192	-.03418	.10876	-.24548	-.22301	.36291	-.61450
.900	-2.278	6.21845	-.12284	.33860	.01300	-.03670	.10970	-.24813	-.10928	.34321	-.31840
.899	-.137	6.23853	.00677	.33618	-.04354	-.03994	.11399	-.25708	.00759	.33617	.02254
.900	1.999	6.23380	.14366	.33391	-.10372	-.04045	.10975	-.25145	.13192	.33872	.38948
.900	4.147	6.22625	.27735	.32763	-.15194	-.04198	.11186	-.25354	.25294	.34683	.72927
GRADIENT		.00301	.06181	-.00182	-.02546	-.00090	.00029	-.00091	.05580	-.00171	.15880

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LARC 8FT TPT 787(LA113) INTEGRATED VEH.,1 STING

(RKH003) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = -6.000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 3/ 0 RN/L = 3.98 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	BETA	CN	CA	CLM	CBL	CYN	CY	CL	CD	L/D
.900	-8.717	-6.19146	-.54023	.35243	.17065	.03356	-.12452	.28968	-.49057	.43024	-1.11699
.900	-6.567	-6.21730	-.38670	.34984	.11101	.03463	-.11959	.28200	-.34416	.39177	-.87848
.899	-4.410	-6.22964	-.24989	.34448	.05770	.03558	-.11294	.26928	-.22266	.36268	-.61395
.900	-2.274	-6.23540	-.12049	.34043	.00642	.03682	-.10808	.25918	-.10690	.34494	-.30989
.900	-.151	-6.23074	.00619	.33760	-.04526	.03879	-.10824	.25265	.00708	.33758	.02096
.899	1.996	-6.22556	.13262	.33378	-.09342	.04023	-.10952	.25436	.12091	.33820	.35751
.900	4.145	-6.22167	.26949	.32650	-.14461	.04256	-.10903	.25922	.24519	.34512	.71043
GRADIENT		.00121	.06043	-.00199	-.02359	.00081	.00030	-.00116	.05442	-.00195	.15511

LARC 8FT TPT 787(LA113) ORBITER ALONE

(RKH004) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = .000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 4/ 0 RN/L = 3.36 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	BETA	CN	CA	CLM	CBL	CYN	CY	CL	CD	L/D
.900	-8.240	.01540	-.43116	.08566	.30666	-.00013	-.00176	.00321	-.41443	.14657	-2.82760
.900	-6.166	.01595	-.32866	.08128	.23670	.00034	-.00219	.00327	-.31803	.11610	-2.73941
.900	-4.109	.01768	-.21838	.07826	.16143	-.00005	-.00131	.00112	-.21221	.09371	-2.26451
.900	-2.067	.01926	-.09775	.08037	.07986	-.00034	-.00013	-.00123	-.09478	.08385	-1.13043
.900	.007	.02075	.02602	.08224	-.00308	-.00012	-.00080	-.00092	.02601	.08224	.31627
.900	2.066	.02646	.13986	.08227	-.08028	-.00002	-.00095	-.00057	.13680	.08726	1.56779
.900	4.117	.02537	.25662	.08329	-.15867	.00031	-.00274	.00199	.24998	.10149	2.46302
.900	6.161	.02643	.36383	.08324	-.23175	.00075	-.00208	.00121	.35279	.12181	2.89633
GRADIENT		.00110	.05769	.00058	-.03888	.00005	-.00018	.00012	.05616	.00092	.59046

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LARC BFT TPT 787(LA113) ORBITER ALONE

(RKH005) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

BETA = 6.000 IB-ELV = 10.000
 OB-ELV = 4.000

PARAMETRIC DATA

RUN NO. 5/0 RN/L = 3.36 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	BETA	CN	CA	CLM	CBL	CYN	CY	CL	CD	L/D
.899	-8.294	6.00764	-.44224	.08121	.31031	-.02791	.08030	-.11461	-.42590	.14416	-2.95432
.900	-6.228	6.03383	-.33585	.07887	.23813	-.02825	.07860	-.11193	-.32531	.11484	-2.83273
.900	-4.159	6.05445	-.22644	.07727	.16396	-.02882	.07739	-.11067	-.22024	.09349	-2.35576
.899	-2.073	6.06532	-.10036	.07889	.07897	-.02979	.07731	-.11058	-.09744	.08247	-1.18165
.900	-.007	6.06836	.02140	.08035	-.00234	-.03129	.07593	-.10852	.02141	.08035	.26646
.900	2.067	6.06417	.14244	.08055	-.08393	-.03274	.07675	-.10910	.13944	.08564	1.62827
.900	4.150	6.05204	.26050	.08151	-.16326	-.03114	.07601	-.10818	.25392	.10015	2.53531
GRADIENT		-.00029	.05861	.00049	-.03937	-.00042	-.00016	.00031	.05710	.00079	.60656

LARC BFT TPT 787(LA113) ORBITER ALONE

(RKH006) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

BETA = -6.000 IB-ELV = 10.000
 OB-ELV = 4.000

PARAMETRIC DATA

RUN NO. 6/0 RN/L = 3.36 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	BETA	CN	CA	CLM	CBL	CYN	CY	CL	CD	L/D
.900	-9.290	-5.99586	-.43157	.08092	.30155	.02918	-.08416	.12186	-.41539	.14230	-2.91915
.900	-6.225	-6.01830	-.32977	.07736	.23333	.02797	-.08020	.11565	-.31944	.11266	-2.83542
.900	-4.157	-6.03489	-.22118	.07519	.15971	.02640	-.07662	.10982	-.21515	.09102	-2.36371
.900	-2.081	-6.04401	-.09616	.07808	.07569	.02733	-.07444	.10561	-.09326	.08152	-1.14396
.900	.004	-6.04654	.02302	.07972	-.00336	.02911	-.07393	.10401	.02302	.07972	.28871
.899	2.086	-6.03885	.14104	.07953	-.08314	.03077	-.07647	.10676	.13805	.08461	1.63151
.900	4.149	-6.03011	.26066	.08080	-.16439	.03090	-.07893	.10994	.25413	.09945	2.55543
GRADIENT		.00071	.05779	.00061	-.03894	.00060	-.00032	.00007	.05630	.00096	.60711

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LARC 8FT TPT 787(LA113) ORB.NEAR TANK,NO HWWARE

(RKH007) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = .000 IB-ELV = 10.000
 08-ELV = 4.000

RUN NO. 7/0 RN/L = 3.36 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	BETA	CN	CA	CLM	CBL	CYN	CY	CL	CD	L/D
.899	-8.097	-.01772	.21836	.09879	.17857	.00004	-.00106	.00325	-.20227	.12856	-1.57328
.901	-6.060	-.01639	.14127	.09807	.12364	.00047	-.00096	.00283	-.13012	.11243	-1.15734
.900	-4.020	-.01097	.05952	.09662	.06553	-.00049	.00091	-.00090	-.05260	.10055	-.52310
.901	-1.981	.00469	.01721	.09407	.01233	-.00192	.00261	-.00462	.02046	.09342	.21897
.900	.069	.00578	.09758	.09139	-.04412	-.00239	.00201	-.00410	.09747	.09150	.06519
.900	2.122	.00636	.18619	.08893	-.10769	-.00212	.00071	-.00249	.18277	.09577	.1.90857
.900	4.136	.00462	.25396	.08774	-.15438	-.00182	.00006	-.00130	.24697	.10583	2.33361
GRADIENT		.00161	.03899	-.00112	-.02743	-.00014	-.00018	.00006	.03730	.00063	.36274

LARC 8FT TPT 787(LA113) ORB.NEAR TANK,NO HWWARE

(RKH008) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = 6.000 IB-ELV = 10.000
 08-ELV = 4.000

RUN NO. 8/0 RN/L = 3.36 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	BETA	CN	CA	CLM	CBL	CYN	CY	CL	CD	L/D
.901	-8.156	6.02143	-.23165	.09885	.18056	-.04864	.09734	-.14987	-.21528	.13072	-1.64694
.901	-6.108	6.04320	-.15542	.09636	.12660	-.04757	.09182	-.14132	-.14429	.11235	-1.28427
.900	-4.048	6.06034	-.07995	.09446	.07384	-.04689	.08697	-.13427	-.07308	.09987	-.73178
.900	-2.006	6.06775	.00011	.09292	.01902	-.04739	.08359	-.12866	.00336	.09286	.03622
.901	.078	6.06736	.08447	.09102	-.03988	-.04712	.07867	-.12069	.08435	.09113	.92554
.900	2.100	6.06019	.16556	.08939	-.09663	-.04579	.07460	-.11357	.16217	.09540	.69998
.900	4.142	6.04426	.22706	.08652	-.13977	-.04200	.07064	-.10719	.22022	.10269	2.14443
GRADIENT		-.00193	.03805	-.00095	-.02650	.00055	-.00203	.00338	.03639	.00040	.36211

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LARC BFT TPT 787(LA113) ORB.NEAR TANK,NO HDWARE

(RKH009) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

BETA = -6.000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 9/ 0 RN/L = 3.37 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	BETA	CN	CA	CLM	CBL	CYN	CY	CL	CD	L/D
.901	-8.137	-6.02902	-.20092	.09780	.16317	.05036	-.10109	.15934	-.18505	.12525	-1.47745
.900	-6.065	-6.05202	-.12026	.09480	.10608	.04922	-.09523	.14982	-.10957	.10698	-1.02418
.901	-4.035	-6.06462	-.04205	.09362	.05188	.04799	-.08890	.13876	-.03536	.09635	-36703
.901	-1.981	-6.06882	.04191	.09145	-.00661	.04595	-.08202	.12651	.04504	.08995	.50079
.900	.069	-6.06533	.11755	.08986	-.05906	.04518	-.07821	.11967	.11744	.09000	1.30489
.901	2.119	-6.05678	.19500	.08822	-.11292	.04336	-.07438	.11325	.19160	.09537	2.00898
.900	4.177	-6.04315	.26796	.08574	-.16453	.04259	-.07265	.11021	.26100	.10503	2.48507
GRADIENT		.00268	.03767	-.00093	-.02627	-.00065	.00196	-.00343	.03602	.00111	.35140

LARC BFT TPT 787(LA113) ORB.NEAR TANK,HDWR ON OB

(RKH010) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

BETA = .000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 17/ 0 RN/L = 3.36 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	BETA	CN	CA	CLM	CBL	CYN	CY	CL	CD	L/D
.900	-8.049	-.02446	-.10899	.10707	.09811	.00194	-.00442	.00718	-.09292	.12128	-.76615
.900	-6.015	-.02068	-.03980	.10379	.04891	.00145	-.00317	.00525	-.02870	.10739	-.26728
.901	-3.981	-.02159	.02792	.10084	.00102	.00063	-.00127	.00174	.03485	.09866	.35328
.900	-1.956	-.00052	.09651	.10033	-.04552	-.00058	-.00007	-.00181	.09988	.09698	1.02995
.901	.081	-.00013	.16997	.10103	-.09583	-.00178	-.00062	-.00279	.16982	.10127	1.67691
.901	2.122	-.00000	.25253	.09970	-.15396	-.00151	-.00059	-.00093	.24866	.10898	2.28166
.900	4.162	-.00440	.31025	.09750	-.19363	-.00153	-.00029	-.00149	.30236	.11976	2.52475
GRADIENT		.00171	.03539	-.00036	-.02444	-.00026	.00013	-.00027	.03358	.00266	.27469

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LA113 (LARC BFT TPT 787) DMS-DR-2397

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LARC BFT TPT 787(LA113) ORB.NEAR TANK,HDWR ON OB

(RKH011) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = 6.000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 11/ 0 RN/L = 3.37 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	BETA	CN	CA	CLM	CBL	CYN	CY	CL	CD	L/D
.900	-8.106	6.00136	-.11428	.11357	.09456	-.04703	.09759	-.15048	-.09713	.12855	-.75553
.902	-6.070	6.02476	-.04326	.11154	.04443	-.04679	.09375	-.14431	-.03123	.11549	-.27039
.901	-4.021	6.04047	.02995	.10852	-.00698	-.04631	.08970	-.13793	.03748	.10615	.35311
.901	-1.971	6.04864	.10392	.10484	-.05762	-.04692	.08667	-.13261	.10747	.10120	1.06191
.901	.081	6.04837	.18438	.10183	-.11332	-.04751	.08283	-.12590	.18424	.10209	1.80466
.900	2.130	6.03953	.25753	.10027	-.16377	-.04494	.07747	-.11707	.25363	.10977	2.31046
.901	4.191	6.02472	.31624	.09869	-.20426	-.04200	.07381	-.11121	.30818	.12154	2.53555
GRADIENT		-.00198	.03538	-.00118	-.02439	.00052	-.00200	.00336	.03350	.00192	.27345

LARC BFT TPT 787(LA113) ORB.NEAR TANK,HDWR ON OB

(RKH012) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = -6.000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 12/ 0 RN/L = 3.36 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	BETA	CN	CA	CLM	CBL	CYN	CY	CL	CD	L/D
.901	-8.097	-6.03473	-.08468	.10956	.07728	.05180	-.10547	.16415	-.06841	.12040	-.56819
.900	-6.050	-6.05850	-.01228	.10688	.02564	.05037	-.09944	.15454	-.00094	.10758	-.00877
.901	-4.003	-6.07494	.05876	.10407	-.02409	.04858	-.09258	.14354	.06588	.09971	.66073
.902	-1.943	-6.08101	.13103	.10036	-.07333	.04760	-.08611	.13167	.13436	.09586	1.40164
.900	.097	-6.08025	.20778	.09757	-.12658	.04762	-.08358	.12604	.20761	.09792	2.12019
.901	2.167	-6.07223	.28196	.09611	-.17754	.04556	-.08099	.12063	.27813	.10670	2.60659
.901	4.190	-6.05881	.34577	.09388	-.22236	.04432	-.07874	.11717	.33799	.11890	2.84269
GRADIENT		.00200	.03537	-.00120	-.02443	-.00052	.00160	-.00311	.03357	.00240	.27180

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LARC BFT TPT 787(LA113) ORB.NEAR TANK,HDWR ON TK

(RKH013) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = .000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 14/ 0 RN/L = 3.36 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	BETA	CN	CA	CLM	CBL	CYN	CY	CL	CD	L/D
.900	-8.076	-.00170	-.12902	.09331	.11132	.00150	-.00377	.00655	-.11463	.11051	-1.03732
.898	-6.042	-.00169	-.05923	.08934	.06171	.00084	-.00283	.00485	-.04950	.09508	-.52059
.900	-4.007	.00207	.01153	.08980	.01197	-.00053	-.00007	.00001	.01778	.08878	.20025
.901	-1.968	.02135	.08827	.08893	-.04113	-.00138	.00106	-.00285	.09127	.08584	1.06323
.900	.081	.02021	.16640	.08545	-.09587	-.00240	.00165	-.00408	.16628	.08568	1.94068
.900	2.121	.02261	.24668	.08277	-.15242	-.00221	.00024	-.00224	.24345	.09185	2.65057
.901	4.151	.01945	.30405	.08086	-.19177	-.00134	.00035	-.00149	.29740	.10266	2.89693
GRADIENT		.00177	.03644	-.00118	-.02543	-.00012	.00000	-.00012	.03487	.00165	.34219

LARC BFT TPT 787(LA113) ORB.NEAR TANK,HDWR ON TK

(RKH014) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = 6.000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 15/ 0 RN/L = 3.36 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	BETA	CN	CA	CLM	CBL	CYN	CY	CL	CD	L/D
.901	-8.140	6.01261	-.12982	.09599	.10446	-.04793	.09806	-.15046	-.11492	.11341	-1.01337
.900	-6.084	6.04002	-.05967	.09195	.05450	-.04757	.09382	-.14373	-.04959	.09776	-.50725
.900	-4.028	6.05919	.00841	.08883	.00687	-.04737	.09031	-.13807	.01463	.08802	.16625
.900	-1.987	6.07148	.08540	.08762	-.04574	-.04806	.08640	-.13199	.08839	.08460	1.04480
.900	.066	6.08088	.16759	.08432	-.10266	-.04824	.08177	-.12419	.16749	.08451	1.98188
.900	2.126	6.07527	.24290	.08158	-.15508	-.04583	.07681	-.11591	.23970	.09054	2.64753
.901	4.158	6.06727	.30254	.07853	-.19642	-.04227	.07253	-.10917	.29605	.10826	2.85267
GRADIENT		.00097	.03641	-.00130	-.02519	.00061	-.00220	.00361	.03486	.00149	.36036

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LARC BFT TPT 787(LA113) ORB.NEAR TANK,HDWR ON TK

(RKH015) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = -6.000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 16/ 0 RN/L = 3.36 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	BETA	CN	CA	CLM	CBL	CYN	CY	CL	CD	L/D
.900	-8.113	-6.01697	-.10264	.09507	.08876	.04978	-.10192	.15923	-.08820	.10861	-.81209
.900	-6.066	-6.04029	-.02933	.09221	.03678	.04883	-.09696	.15108	-.01943	.09479	-.20495
.900	-4.007	-6.05281	.04486	.08999	-.01506	.04674	-.08935	.13860	.05103	.08653	.58976
.900	-1.957	-6.05635	.11949	.08661	-.06616	.04601	-.08316	.12742	.12237	.08248	1.48359
.900	.095	-6.05474	.19747	.08442	-.12001	.04489	-.07877	.11920	.19733	.08475	2.32851
.900	2.134	-6.04808	.27130	.08142	-.17145	.04379	-.07736	.11591	.26808	.09146	2.93104
.900	4.177	-6.03667	.33861	.07886	-.22000	.04271	-.07387	.11274	.33196	.10332	3.21297
GRADIENT		.00198	.03614	-.00133	-.02518	-.00050	.00180	-.00309	.03459	.00208	.32725

LARC BFT TPT 787(LA113) INTEGRATED VEH.,I STING

(SKH001) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = .000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 1/ 0 RN/L = 3.98 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	CPB1	CPB2	CPB3	CPB4	CPB5	CPB6	CPB7	RN/L	Q(PSF)
.901	-8.644	-.27747	-.29768	-.26430	-.27894	-.39949	-.38618	-.37864	3.99179	711.30404
.900	-6.500	-.26809	-.28676	-.25842	-.27084	-.38067	-.36879	-.35559	3.98240	711.06849
.900	-4.369	-.25907	-.27852	-.25289	-.26478	-.35615	-.34526	-.33687	3.98226	711.05735
.900	-2.247	-.25729	-.27742	-.25122	-.26759	-.33700	-.32576	-.31504	3.98040	710.75114
.899	-.131	-.24999	-.27651	-.24663	-.26216	-.31896	-.30233	-.32266	3.97603	709.94162
.900	1.992	-.25017	-.27265	-.24348	-.25952	-.31518	-.29354	-.32814	3.97979	710.40357
.900	4.113	-.25730	-.26607	-.24659	-.26468	-.31402	-.29619	-.33053	3.98034	711.02537
GRADIENT		.00050	.00140	.00096	.00039	.00500	.00615	-.00002	-.00021	-.01936

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LARC BFT TPT 787(LA113) INTEGRATED VEH.,1 STING

(SKH002) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = 6.000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 2/ 0 RN/L = 3.98 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	CPB1	CPB2	CPB3	CPB4	CPB5	CPB6	CPB7	RN/L	Q(PSF)
.900	-8.709	-.29984	-.33263	-.29847	-.31394	-.40750	-.39150	-.30153	3.98072	710.54545
.899	-8.561	-.29228	-.32065	-.29151	-.30689	-.38696	-.37741	-.29988	3.97948	709.95072
.900	-4.406	-.28288	-.30709	-.28140	-.29729	-.37182	-.36072	-.28913	3.99169	711.14418
.900	-2.278	-.27376	-.29344	-.27134	-.28677	-.36091	-.35012	-.28659	3.97776	710.23905
.899	-.137	-.26720	-.28300	-.26472	-.27904	-.35093	-.34181	-.29154	3.97797	709.87301
.900	1.999	-.26511	-.28601	-.26695	-.27928	-.33892	-.32612	-.29879	3.98041	710.70064
.900	4.147	-.26430	-.28699	-.26726	-.27925	-.33199	-.31996	-.30535	3.97839	710.48600
GRADIENT		.00214	.00223	.00153	.00204	.00475	.00493	.00209	-.00018	-.03985

LARC BFT TPT 787(LA113) INTEGRATED VEH.,1 STING

(SKH003) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = -6.000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 3/ 0 RN/L = 3.98 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	CPB1	CPB2	CPB3	CPB4	CPB5	CPB6	CPB7	RN/L	Q(PSF)
.900	-8.717	-.30394	-.31702	-.27707	-.29538	-.41153	-.39887	-.43762	3.97953	710.33498
.900	-6.567	-.29251	-.30448	-.26706	-.28533	-.39244	-.38213	-.43313	3.98137	710.74201
.899	-4.410	-.27941	-.29075	-.25611	-.27414	-.37851	-.36738	-.42687	3.97751	709.46133
.900	-2.274	-.26811	-.27876	-.24581	-.26322	-.35940	-.34639	-.41256	3.98255	711.02537
.900	-.151	-.25886	-.27020	-.23806	-.25536	-.35242	-.33717	-.40461	3.98055	710.70997
.899	1.996	-.25793	-.27195	-.23723	-.25453	-.34307	-.32992	-.39619	3.97680	710.19780
.900	4.145	-.25812	-.27234	-.23655	-.25517	-.33447	-.32099	-.39445	3.98077	710.92940
GRADIENT		.00247	.00204	.00223	.00218	.00488	.00511	.00380	.00004	.09858

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LARC BFT TPT 787(LA113) ORBITER ALONE

(SKH004) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = .000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 4/ 0 RN/L = 3.36 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	CPB1	CPB2	CPB3	CPB4	RN/L	Q(PSF)
.900	-8.240	-.27544	-.28358	-.26838	-.27941	3.35924	600.26584
.900	-6.166	-.25487	-.26026	-.26184	-.26600	3.35780	599.91393
.900	-4.109	-.24340	-.24604	-.24141	-.25059	3.35871	600.17901
.900	-2.067	-.23885	-.23991	-.23178	-.24455	3.35741	600.00075
.900	.007	-.23592	-.23658	-.22912	-.24252	3.35757	599.74473
.900	2.066	-.23463	-.23450	-.22653	-.23936	3.36020	600.00075
.900	4.117	-.23747	-.23510	-.22582	-.24023	3.36230	600.16986
.900	6.161	-.24026	-.24026	-.22728	-.24330	3.36418	600.11960
GRADIENT		.00078	.00133	.00177	.00126	.00048	-.00090

LARC BFT TPT 787(LA113) ORBITER ALONE

(SKH005) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = 6.000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 5/ 0 RN/L = 3.36 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	CPB1	CPB2	CPB3	CPB4	RN/L	Q(PSF)
.899	-8.294	-.28718	-.28066	-.27478	-.29390	3.35694	599.44736
.900	-6.228	-.27403	-.26845	-.25936	-.28011	3.35823	599.89100
.900	-4.159	-.26439	-.25961	-.25399	-.26893	3.36098	600.20643
.899	-2.073	-.25820	-.25739	-.24705	-.26471	3.35934	599.53417
.900	.007	-.24973	-.25645	-.24219	-.26123	3.35995	599.88188
.900	2.067	-.24075	-.25288	-.23511	-.25803	3.36191	600.20643
.900	4.150	-.23657	-.24805	-.23280	-.25210	3.36260	600.08758
GRADIENT		.00352	.00133	.00262	.00194	.00028	.02083

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LARC BFT TPT 787(LA113) ORBITER ALONE

(SKH006) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

BETA = -6.000 IB-ELV = 10.000
 08-ELV = 4.000

PARAMETRIC DATA

RUN NO. 6/0 RN/L = 3.36 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	CPB1	CPB2	CPB3	CPB4	RN/L	Q(PSF)
.900	-8.290	-.28620	-.30885	-.27446	-.29038	3.35999	599.56633
.900	-6.225	-.26613	-.28787	-.26752	-.27535	3.36231	600.11960
.900	-4.157	-.25646	-.26435	-.25385	-.26374	3.36222	599.90925
.900	-2.081	-.25090	-.25419	-.24309	-.25775	3.36143	599.91837
.900	.004	-.24740	-.24634	-.23738	-.25422	3.36166	600.08758
.899	2.086	-.24959	-.24126	-.23417	-.25443	3.35933	599.58456
.900	4.149	-.25360	-.24330	-.23567	-.25808	3.35997	599.78121
GRADIENT		.00034	.00265	.00218	.00071	-.00032	-.02841

LARC BFT TPT 787(LA113) ORB.NEAR TANK, NO HOWARE

(SKH007) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

BETA = .000 IB-ELV = 10.000
 08-ELV = 4.000

PARAMETRIC DATA

RUN NO. 7/0 RN/L = 3.36 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	CPB1	CPB2	CPB3	CPB4	RN/L	Q(PSF)
.899	-8.097	-.32717	-.32469	-.32133	-.32684	3.36186	599.51596
.901	-6.060	-.32476	-.31794	-.32196	-.32575	3.36222	600.80019
.900	-4.020	-.31907	-.31106	-.31421	-.31975	3.35794	600.08758
.901	-1.981	-.31468	-.30655	-.30907	-.31559	3.35705	600.66317
.900	.069	-.30836	-.30062	-.29990	-.30936	3.35410	599.86362
.900	2.122	-.30319	-.29771	-.29477	-.30469	3.35360	599.62581
.900	4.136	-.29811	-.28801	-.29038	-.30050	3.35571	599.74473
GRADIENT		.00262	.00269	.00304	.00242	-.00039	-.08456

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LARC BFT TPT 787(LA113) ORB.NEAR TANK,NO HDWARE

(SKH008) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = 6.000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 8/ 0 RN/L = 3.38 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	CPB1	CPB2	CPB3	CPB4	RN/L	Q(PSF)
.901	-8.156	-.34710	-.35132	-.35196	3.36412	600.48510	
.901	-6.108	-.34324	-.34681	-.33100	3.36425	600.54446	
.900	-4.048	-.33840	-.34145	-.32514	3.36467	599.99162	
.900	-2.006	-.33317	-.33543	-.31746	3.36700	600.38464	
.901	.078	-.32846	-.33033	-.31344	3.36319	600.55362	
.900	2.100	-.32310	-.32142	-.30693	3.36128	599.95957	
.900	4.142	-.31826	-.31791	-.30174	3.36061	599.86362	
	GRADIENT	.00246	.00298	.00280	.00250	-.00045	-.03299

LARC BFT TPT 787(LA113) ORB.NEAR TANK,NO HDWARE

(SKH009) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = -6.000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 9/ 0 RN/L = 3.37 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	CPB1	CPB2	CPB3	CPB4	RN/L	Q(PSF)
.901	-8.137	-.34370	-.34895	-.32950	-.34482	3.35891	600.66317
.900	-6.065	-.33641	-.34026	-.32159	-.33747	3.35635	599.77680
.901	-4.035	-.33173	-.33505	-.31407	-.33130	3.35922	600.36634
.901	-1.981	-.32814	-.33028	-.30999	-.32849	3.35986	600.39925
.900	.069	-.32446	-.32238	-.30527	-.32438	3.36258	600.13787
.901	2.119	-.32087	-.31669	-.30368	-.32182	3.36320	600.43487
.900	4.177	-.31102	-.29735	-.29377	-.31270	3.36523	600.34353
	GRADIENT	.00237	.00434	.00229	.00214	.00075	-.00044

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LARC BFT TPT 787(LA113) ORB.NEAR TANK,HDWR ON OB

(SKH010) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = .000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 17/ 0 RN/L = 3.36 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	CPB1	CPB2	CPB3	CPB4	RN/L	Q(PSF)
.900	-8.049	-.23773	-.26361	-.21360	-.23305	3.36647	600.09671
.900	-6.015	-.23067	-.25194	-.20896	-.22687	3.36857	600.26584
.901	-3.981	-.22532	-.24303	-.20824	-.22454	3.36628	600.45318
.900	-1.956	-.22621	-.24524	-.21357	-.23208	3.36271	600.19729
.901	.081	-.24393	-.25266	-.22527	-.25272	3.36041	600.43487
.901	2.122	-.24670	-.25187	-.22645	-.25591	3.35748	600.42572
.900	4.162	-.24202	-.24152	-.22755	-.25120	3.35784	599.59845
GRADIENT		-.00265	-.00018	-.00253	-.00379	-.00109	-.07277

LARC BFT TPT 787(LA113) ORB.NEAR TANK,HDWR ON OB

(SKH011) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = 6.000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 11/ 0 RN/L = 3.37 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	CPB1	CPB2	CPB3	CPB4	RN/L	Q(PSF)
.900	-8.106	-.26868	-.30467	-.26766	-.28685	3.35804	600.41207
.902	-6.070	-.26423	-.29647	-.26075	-.28260	3.36309	601.54442
.901	-4.021	-.25742	-.29010	-.25595	-.27982	3.36170	600.82770
.901	-1.971	-.24632	-.27756	-.24440	-.26631	3.36359	600.89183
.901	.081	-.23949	-.27362	-.23972	-.26168	3.36366	601.15188
.900	2.130	-.23760	-.27190	-.23300	-.25807	3.36363	600.57660
.901	4.191	-.24542	-.27085	-.23134	-.25955	3.36566	601.16105
GRADIENT		.00159	.00215	.00295	.00228	.00039	.01717

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LA113 (LARC BFT TPT 787) DMS-DR-2397

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LARC BFT TPT 787(LA113) ORB.NEAR TANK,HDWR ON OB

(SKH012) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = -6.000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 12/ 0 RN/L = 3.36 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	CPB1	CPB2	CPB3	CPB4	RN/L	Q(PSF)
.901	-8.097	-.26698	-.28607	-.23638	-.26347	3.36730	600.89222
.900	-6.050	-.25807	-.27495	-.22751	-.25543	3.36508	600.54916
.901	-4.003	-.25302	-.26686	-.22136	-.25049	3.36620	601.24790
.902	-1.943	-.24547	-.25984	-.21465	-.24341	3.36617	601.34817
.900	.097	-.23916	-.25541	-.20820	-.23625	3.36286	600.32066
.901	2.167	-.23681	-.25894	-.20602	-.23441	3.36437	600.93287
.901	4.190	-.23707	-.25894	-.20825	-.23521	3.36344	600.93287
GRADIENT		.00198	.00097	.00170	.00193	-.00036	-.05093

LARC BFT TPT 787(LA113) ORB.NEAR TANK,HDWR ON TK

(SKH013) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = .000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 14/ 0 RN/L = 3.36 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	CPB1	CPB2	CPB3	CPB4	RN/L	Q(PSF)
.900	-8.076	-.26941	-.27494	-.25327	-.27878	3.35718	600.04640
.898	-6.042	-.26041	-.26530	-.24509	-.27106	3.35504	598.87019
.900	-4.007	-.27123	-.26714	-.25548	-.27982	3.35901	600.09671
.901	-1.968	-.27674	-.27252	-.26345	-.28324	3.36258	600.45318
.900	.081	-.27066	-.26368	-.25622	-.27605	3.36471	600.20643
.900	2.121	-.26318	-.25501	-.24762	-.26798	3.36536	600.40293
.901	4.151	-.25231	-.24626	-.23761	-.25942	3.36481	600.53086
GRADIENT		.00252	.00290	.00253	.00275	.00071	.04006

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LA113 (LARC BFT TPT 787) DMS-DR-2397

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LARC BFT TPT 787(LA113) ORB.NEAR TANK,HDWR ON TK

(SKH014) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = 6.000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 15/ 0 RN/L = 3.36 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	CPB1	CPB2	CPB3	CPB4	RN/L	Q(PSF)
.901	-9.140	-.30653	-.32126	-.29015	-.31751	3.35974	600.50341
.900	-6.084	-.29516	-.30727	-.27427	-.30446	3.35952	600.28412
.900	-4.028	-.28583	-.29782	-.26356	-.29599	3.36191	600.20643
.900	-1.987	-.28575	-.29352	-.27146	-.29844	3.36169	599.82243
.900	.066	-.27697	-.28343	-.26301	-.28880	3.36221	599.95957
.900	2.126	-.26856	-.27673	-.25452	-.27792	3.35995	599.88166
.901	4.158	-.25997	-.27368	-.24469	-.26607	3.36174	600.51256
GRADIENT	.00336	.00318	.00267	.00392	.00010	.03272	

LARC BFT TPT 787(LA113) ORB.NEAR TANK,HDWR ON TK

(SKH015) (11 OCT 77)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 976.0000 IN. XT
 LREF = 1290.3000 INCHES YMRP = .0000 IN. YT
 BREF = 1290.3000 INCHES ZMRP = 400.0000 IN. ZT
 SCALE = .0100

PARAMETRIC DATA

BETA = -6.000 IB-ELV = 10.000
 OB-ELV = 4.000

RUN NO. 16/ 0 RN/L = 3.36 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	CPB1	CPB2	CPB3	CPB4	RN/L	Q(PSF)
.900	-8.113	-.30218	-.30795	-.28845	-.30794	3.36070	600.23841
.900	-6.066	-.29462	-.29974	-.28146	-.29940	3.36098	600.04190
.900	-4.007	-.28763	-.29276	-.27400	-.29049	3.36096	600.30695
.900	-1.957	-.28222	-.28498	-.26626	-.28557	3.36189	600.30695
.900	.095	-.27885	-.28055	-.26356	-.28124	3.36164	600.18815
.900	2.134	-.27362	-.27335	-.26113	-.27718	3.36125	600.06018
.900	4.177	-.26662	-.26509	-.25391	-.26998	3.36322	600.38464
GRADIENT	.00247	.00318	.00221	.00241	.00019	-.00449	

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